MODERN PLASTICS

March 1956

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Number 7

Editorial

The Plastiscope

General Section

Plastics Engineering

Technical Section

Departments

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Editorial

The pitfall of price

A discussion of recent downward price changes in resins begins on page 256 of this issue and is decidedly recommended reading for all product engineers and designers. While the prices of almost all materials with which plastics compete have consistently risen, the prices of plastics have just as consistently gone down. In this fact lies tremendous opportunity for the use of plastics in new fields of application, and for their increased use in present fields. But in this fact also lies a fearsome pitfall.

That is the pitfall of misapplication, thoughtless design, and the lowering of quality standards.

Ten years ago when all materials were generally unavailable, plastics people concerned with the future emphasized in all end-user contacts that plastics were basically not inexpensive materials and that plastics should be used where they could do a given job better than other materials, or as well as other materials but at lower cost. In the past decade, except for spot lapses generally resulting from cupidity of entrepreneurs who had little knowledge of or respect for plastics, design of plastic products and components has steadily improved, the bases of application have broadened, and many standards have been established and accepted.

Now, with tremendous and still-increasing capacity for plastics production, with greater manufacturing efficiency and consequent lower prices of plastics, and with end product price competition at consumer level, some people may be inclined to use plastics where and in ways in which they should not be used.

It behooves everyone concerned to maintain a constant watch on this pitfall, to stand fast by present standards, and to aid in the establishment of further standards in areas of application in which none have yet been invoked.

Thanks to good engineering leadership, to merchandising sense in the industry, and to excellent public relations effort, plastics are today held in the highest esteem and the public is gaining the ability to discern between proper and improper use of plastics. The tremendous increase in the sale of resins last year was proof of this.

Let's keep it that way!

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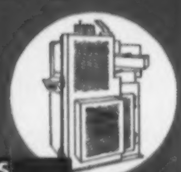

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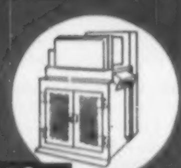

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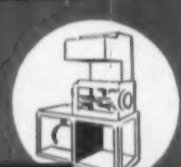

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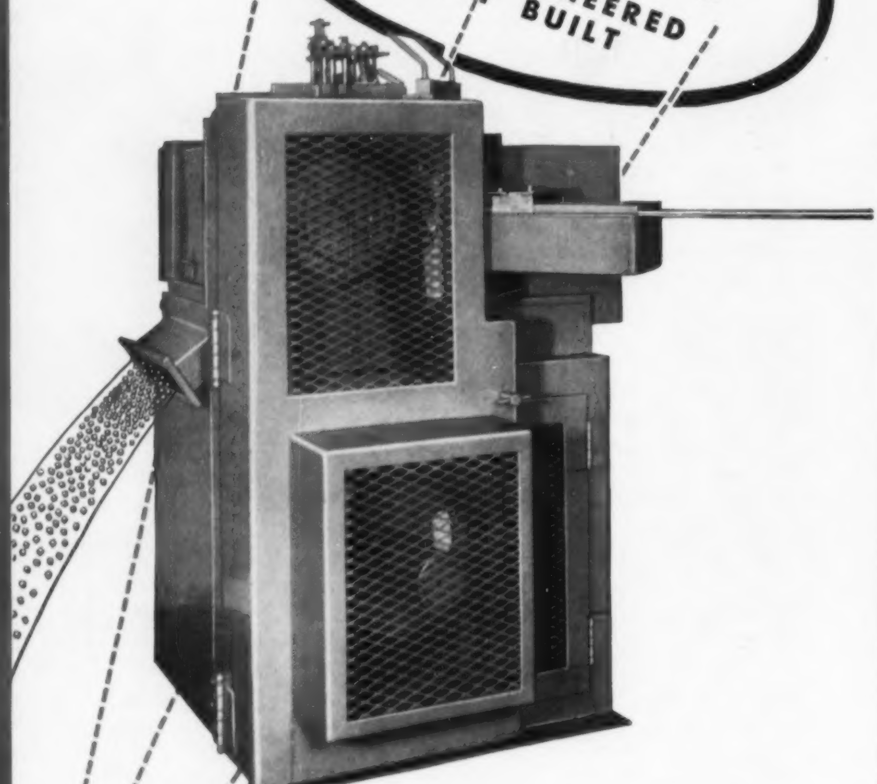

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"REEDS" are known for their high speed. But also important in molding this 199-square inch projected casting area without flash was the "REED" exclusive, full locking tonnage feature. This plus the "Reed-Speed" heating cylinder, which gives faster, more thorough plasticizing, assures you a combination of top quality production at low cost.

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ZYTEL® is being molded into assorted hospital ware that can be autoclaved, resists alcohol, alkalies and dilute acids. It won't break when dropped, is warm to the touch and its use reduces noise.

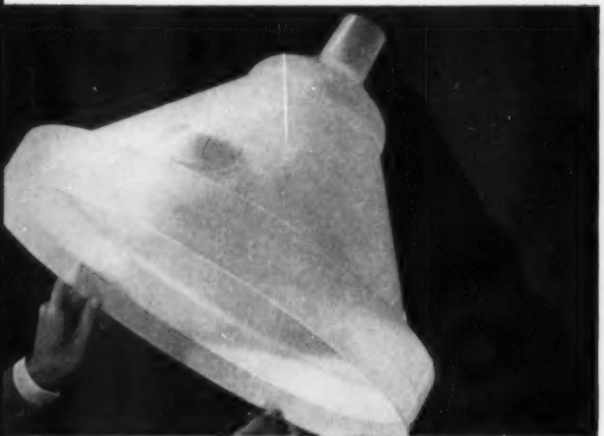
4 more examples of

Every day, new uses are being found for the Du Pont engineering materials. You may find, as others have, that you can give your product greater operating efficiency and longer life by incorporating these engineering materials into its design.

ZYTEL nylon resin is being molded into assorted hospital ware. These basins, cups, jars, tumblers, etc., can be autoclaved... sterilized with conventional cold sterilizing agents... boiled or washed in a dishwasher. They resist alcohol, alkalies and the dilute acids in general use in the hospital and medical field. "Zytel" will not crack, chip or peel and won't break if dropped. Hospital ware of "Zytel" is lightweight, but tough and rigid. It is warm to the touch, and its use reduces noise. (Molded by Zylon Products Company, Providence, Rhode Island.)

ALATHON polyethylene resin is molded into an insulation shield for the picture tube in the new RCA Victor color-TV set. When the set is operating, "Alathon" provides excellent insulation. In addition, the easily molded "Alathon" shield gives added protection to the tube when it is being shipped or handled. "Alathon" not only has excellent insulating properties, but is also strong, lightweight, flexible and corrosion-resistant. (Molded by Sinko Manufacturing Co., Chicago, Ill.)

LUCITE acrylic resin is being used for the adjustable panels in the latest General Electric



ALATHON® provides insulation for color-TV picture tubes. It is readily molded into the complex shape required and has good dielectric properties.

LUCITE® was chosen for the adjustable panels of this new kitchen ventilator. Panels are sparkling clear, feature high impact strength and resist weather.

advanced product engineering

kitchen ventilator. These attractive, sparkling-clear panels of "Lucite" have light-transmission properties comparable to those of finest optical glass. "Lucite" is shatter-resistant. Aging, sunlight and moisture have little, if any, effect on Du Pont "Lucite." (Panels of "Lucite" molded by Plastic Department of General Electric Company, Pittsfield, Mass.)

TEFLON tetrafluoroethylene resin in porous form is being used for disk and cup filters. The filters can be used for commercial acids, caustic and organic solvents, including fuming nitric acids, aqua regia and hydrogen peroxide. It will handle all reagents, and can be chemically cleaned and sterilized. It will filter particles larger than 3 microns out of liquids, larger than one-tenth micron out of gases. (Filters manufactured by Porous Plastic Filter Company, Inc., Glen Cove, New York.)

You can get complete property information on the Du Pont engineering materials by using the coupon at right.

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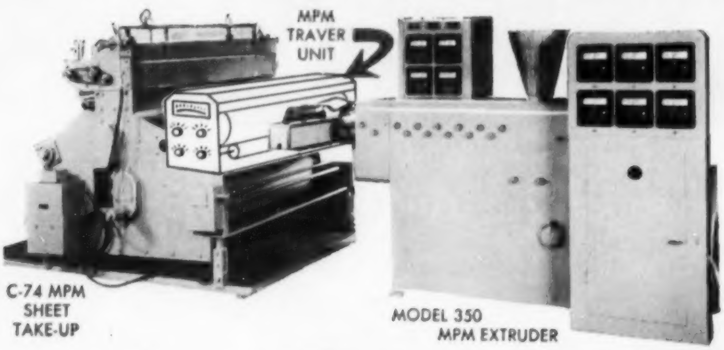

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THIS mpm "PACKAGED UNIT" WITH mpm-TRAVER TREATER

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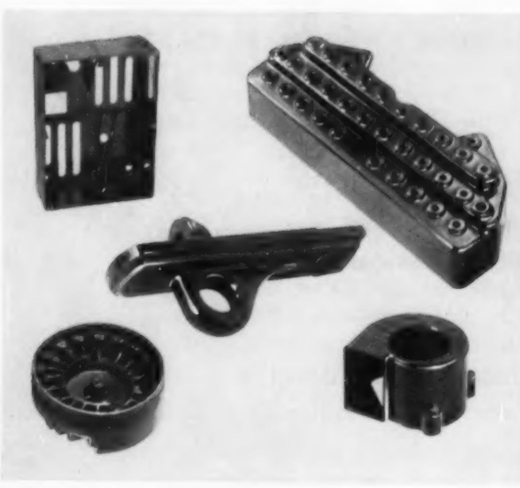

in plastics too... ... you'll find it, *without reservation,* at Kurz-Kasch. We keep our wigs warm worrying about your plastic problems. The more complex the shape, the more intricate the mold . . . the more we enjoy *unzipping your woes.* We have the men, the equipment, *and many moons behind us!* We can efficiently handle your job completely from design to finish! Compression, transfer and plunger molding are second nature to us. *In one pow-wow,* we can tell you if your part can best be molded in one of the standard thermosetting plastics or if the newer Teflon or glass-filled polyesters would serve you better. and speaking of *injunuity* . . . here, they'd go bald trying *to save your scalp.* Kurz-Kasch can be a "heap big help" — why not give us a call?

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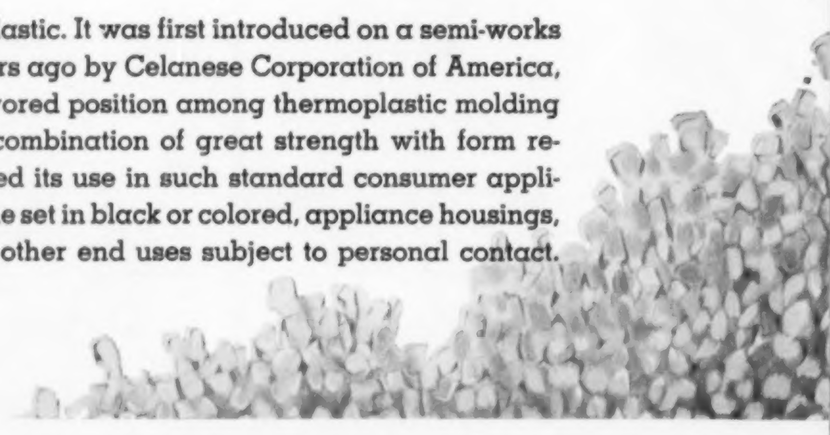
FORTICEL*

(CELLULOSE PROPIONATE PLASTIC)

High Performance Thermoplastic Molding Material with Outstanding Range of Balanced Properties... Available in Choice of Colors and Formulations

Forticel is not a new plastic. It was first introduced on a semi-works basis a number of years ago by Celanese Corporation of America, and quickly won a favored position among thermoplastic molding materials. Its unique combination of great strength with form retention literally dictated its use in such standard consumer applications as the telephone set in black or colored, appliance housings, the fountain pen and other end uses subject to personal contact.



An Overnight Reputation

Applications like these quickly put Forticel in the forefront position among thermoplastic molding materials. Forticel had the qualities needed by molder and manufacturer. In addition to its toughness and dimensional stability, this cellulosic plastic possesses unusual weatherability, surface beauty and permanence, color, and, perhaps as important as anything else, Forticel is free of objectionable odor.

A Molder's Plastic

In molding performance, Forticel is outstanding. Flow temperatures are not as critical . . . welds are stronger . . . surface details of molded parts are superb . . . flash lines are all but invisible . . . molded surfaces are lustrous, and require little or no buffing or polishing . . . molded-in metal inserts hold firmly.

A Fabricator's Plastic

Forticel also machines well. It can be sawed, cut, drilled, threaded and punched with far less danger of stress lines and crazing. This machinability is of vital importance in such applications as fountain pens and mechanical pencils, toothbrush handles and scale model trains, and appliance housings.

First Production of Forticel Stopped

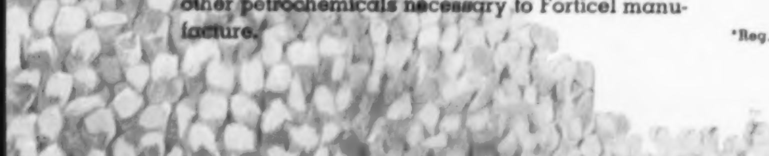
When originally introduced, Forticel was produced in a pilot plant operation. And, because of the difficulty of obtaining raw materials of acceptable quality and cost, commercial production was delayed until such a time as raw materials could be produced in volume—at a price that would insure a competitive position for Forticel.

Production of the New Forticel Begun

After continued development, the new Forticel is currently moving into full scale production. More important to molder and manufacturer is the news that the raw materials of Forticel are *Celanese produced*—and in volume!

New Facilities For Forticel

To be certain that the supply of Forticel raw materials will be adequate to meet the anticipated demand for this outstanding plastic, Celanese has installed new facilities for their production. This will insure a dependable source of supply. These facilities will produce Propionic Acid and other petrochemicals necessary to Forticel manufacture.



The New Forticel

What about the new Forticel? What is it like? What makes it the right plastic for appliance housings, automotive steering wheels, accessories, scale models, sunglass frames, fountain pens, etc.? In the first place, today's Forticel is an even better plastic than its predecessor. This is the result of continued research into the development of new plasticizers, and improvements in processing.

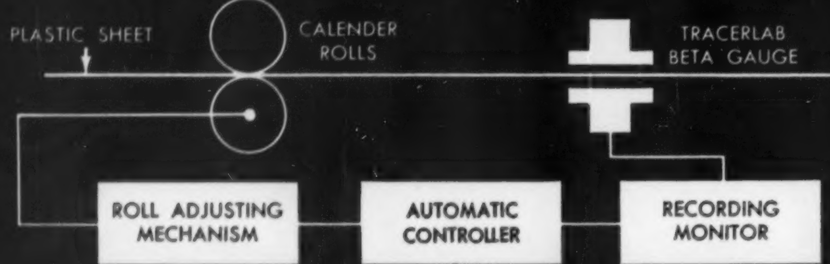
A cellulosic, Forticel has *natural* impact strength or toughness. This is combined with a fine balance of desirable properties including, form retention, low mold shrinkage, weatherability and surface hardness. The new Forticel is available in a full color range, and supplied in uniform pellet size. Sample quantities are available for evaluation. The New Product Bulletin, NP-16 is ready for distribution. This bulletin covers the complete Forticel story from chemical and physical properties to molding and fabricating.

Celanese Corporation of America, Plastics Division, Dept. 101-C, 290 Ferry Street, Newark 5, N. J. Canadian affiliate, Canadian Chemical Company, Limited, Montreal, Toronto and Vancouver.

Typical Physical Properties of Forticel

Flow temperature .	(°C.) (A.S.T.M.). .	D569-48	167—178
Specific gravity		D176-42T	1.18—1.21
Tensile properties:.	Yield (p.s.i.). . . .	D638-52T	3380—5020
	Break (p.s.i.) . . .	D638-52T	3470—5240
	Elongation (%) . . .	D638-52T	56—88
Flexural properties:	Flexural strength . .		
	(p.s.i. at break) . .	D790-49T	6400—8500
	Flexural modulus . .		
	(10^6 p.s.i.)	D790-49T	0.23—0.30
Rockwell Hardness:	(R scale)	D785-51	62—94
Izod Impact	(ft. lb./in. notch) .	D256-43T	2.7—11.0
Heat distortion . .	(°C.)	D648-45T	59—70
Water absorption—	% Sol. lost	D570-42	0.00—0.08
	% Moisture gain . .	D570-42	1.5—1.8
	% Water absorption	D570-42	1.6—1.8

now . . . AUTOMATION IN PLASTIC SHEET PRODUCTION!



Here's how you can benefit with Tracerlab's new system of automatic control:

- **precise, fully automatic control of gauge**
- **faster, higher quality production — no "off gauge" stock**
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- **minimum supervision and attention required**

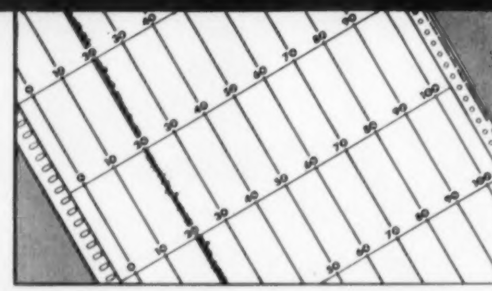
At last you can apply an automatic control system to the production of plain or embossed plastic sheet and reap the benefits of automation in *your* operations.

Tracerlab Beta Gauges and associated "feedback" correction and control equipment provide precise, continuous control to maintain the required thickness exactly, and eliminate costly, wasteful "off gauge" production. You do away with customer complaints and rebates due to off-spec gauge or yield.

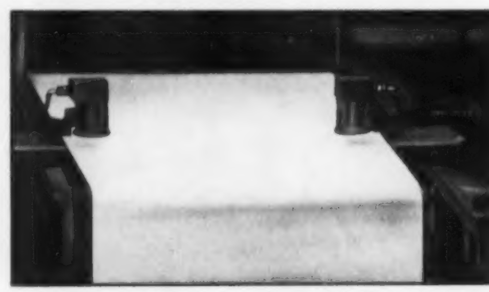
This Tracerlab equipment is *fully automatic* . . . needs almost no supervisory attention. And your machine operators are released for other, more productive work. To get a run started, you simply set the desired thickness on the control console, then forget about it. The Tracerlab system continuously scans the sheet and instantly and automatically applies corrections to the calender rolls whenever any "drift" occurs.

You eliminate shut-downs for manual gauging . . . get increased production of far higher quality sheet. In addition, the Tracerlab system maintains its own permanent record of production on each run and through each shift.

If you have a problem that involves control of sheet thickness *either plain or embossed*, it will pay you to investigate the advantages of Tracerlab Beta Gauging with automatic control — an application of nuclear energy that quickly pays for itself.



Record of production shows exceptional precision of thickness control you can achieve with Tracerlab equipment.

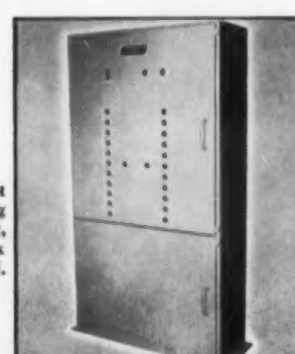


In a typical installation, Tracerlab Beta Gauges monitor both ends of wide plastic sheet.

How Tracerlab Automatic Beta Gauging Works

Tracerlab Beta Gauge continuously monitors sheet thickness. Reading from Beta Gauge is recorded on monitor. Thickness is compared to preset standard. Difference (if any) is applied to control mechanism which adjusts calender rolls automatically.

Write today for data ....



Accessory equipment provides for presetting thickness, recording, and continuous feedback correction and control.

Tracerlab Keleket Tracerlab

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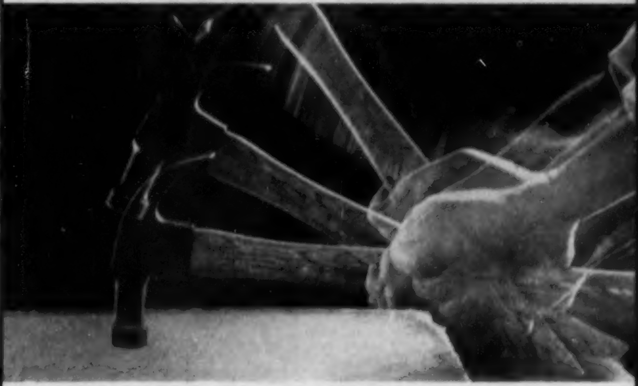
Test boat demonstrates of Versamid*-epoxy

No fear of delamination here! Versamid-epoxy alloys adhere to glass fabric or mats, not just surround them. This gives laminates tremendous strength at high or low temperatures. A quick switch from broiling sun to freezing cold won't crack, distort or weaken them in any way. Versamid-epoxy alloys can be pigmented so they don't need paint, but the tough, glossy surface takes paint beautifully if necessary. Laminated products using this alloy show outstanding resistance to abrasion, mechanical impact, thermal shock, moisture, and solvents. Versamid-epoxy alloys can be applied with spray, knife or roller . . . bond to almost any surface with contact pressure only.

Investigate Versamids the versatile polyamide resins made only by...,* **CHEMICAL DIVISION

exciting properties alloy laminates!

Safety note! Versamid-epoxy alloys emit no toxic or flammable fumes . . . have never been known to cause dermatitis.



Super tough! Tremendous impact resistance suggests many uses. Takes smashing blows like this without delamination.

How about your ideas? You probably can think of many uses for General Mills Versamids in other glass fiber laminates. Plastic pipe, modern furniture, aircraft components, automobile bodies, swimming pools, and printed circuit bases are among the "naturals." Versamid-epoxy alloys can be formulated to varying degrees of hardness. They cure with or without heat in a relatively short time. Versamid-epoxy alloys can be formulated to hold without "running" on vertical surfaces. Only Versamid polyamide resins make these alloys possible. To learn why, write for Technical Bulletin 11-E. If possible, state production needs so we can be of maximum service.

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the color makes the **SALE!**

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A convincing number of polyester manufacturers have profitably learned this fact:

Increased filler loadings—up to 70% of the resin-filler mix—can increase flexural strength and lower water absorption. Your costs go down.

What fillers? DIAMOND suggests these three:

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SUSPENSO®—Particle size: 1 to 5 microns. Uncoated. Oil absorption 20-22 cc per 100 grams.

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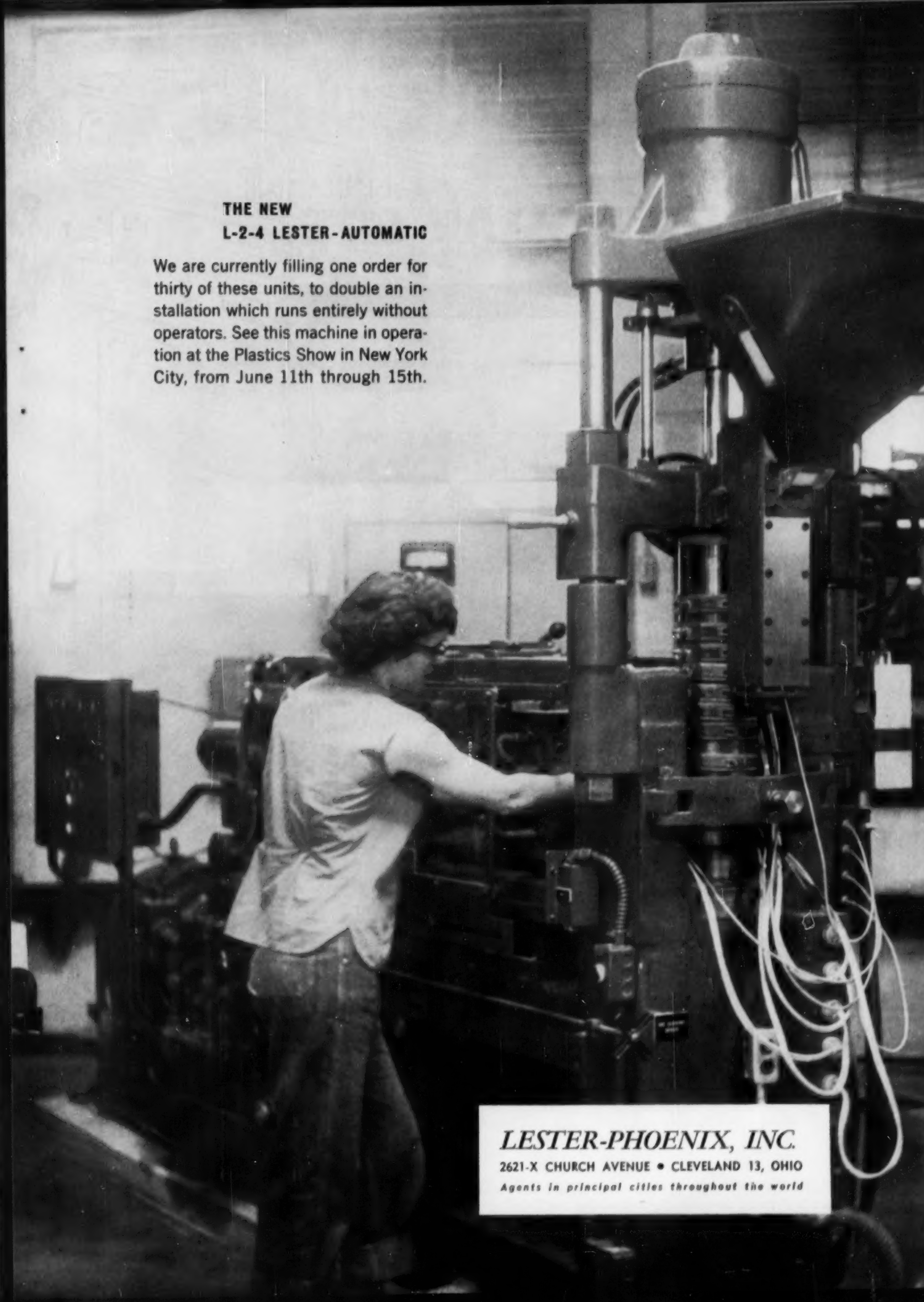
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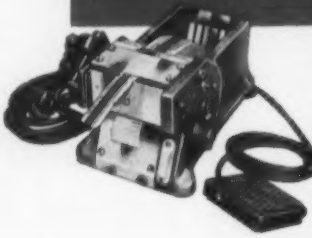

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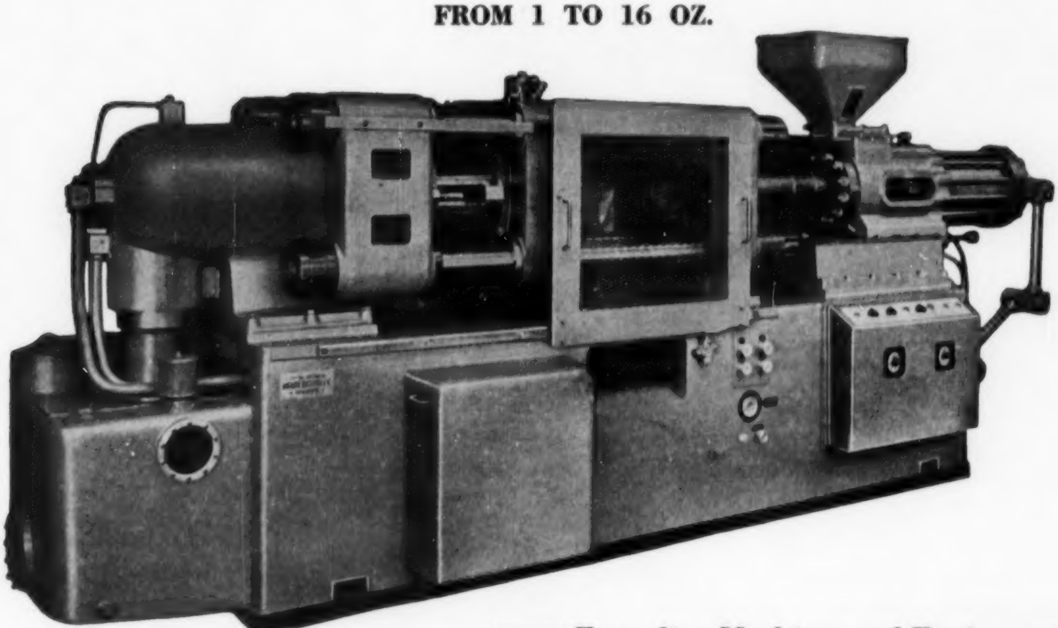

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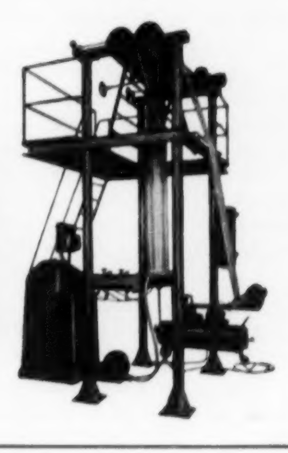

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The Plastiscope

March 1956

News and interpretations of the news   By R. L. Van Boskirk

Nylon price reduction. Following a trend which started last summer when vinyl chloride resin prices were cut is the recent Du Pont announcement concerning Zytel nylon resins. Zytel 101 general-purpose molding material is now $1.35 a lb. on orders of from 2000 to 20,000 lb.; former price was $1.45. Carloads dropped from $1.43½ to $1.33; a year ago the price was $1.60. Zytel 61, a soluble resin for films, coatings, and finishes, and Zytel 63, a special composition for extrusion, have been reduced from $2.10 to $1.83 for carloads. Prices for colored resins were reduced only 5¢ a lb. in comparison with 10¢ for natural.

Mylar prices trimmed again. A reduction of 25¢ a lb. for Mylar polyester film is the third since the start of commercial operations at Circleville, Ohio, in the summer of 1954. Cost now ranges from $2.25 a lb. for most heavy gages to $4.00 a lb. for ¼-mil thickness. The packaging industry is most interested in the $2.75-a-lb. ½-mil film because of Mylar's great strength, but when it was $3.50 a lb., enthusiasm was considerably chilled. Now the industry is starting to compare the Mylar history with cellophane which, introduced in 1925 at $2.51 a lb. and at one time as low as 38¢ a lb., now sells in the 60¢ range.

Polyethylene for Brazil. Two announcements have recently been made about polyethylene plant construction in Brazil. One is that Union Carbide will erect a plant to be operated by its subsidiary, Union Carbide do Brazil, at a site near Santos. Arrangements for an ethylene supply have already been completed. The plant will have a capacity to produce enough conventional polyethylene to satisfy Brazil's requirements for the next 5 to 10 years and, according to U.C. officials, the facilities can be easily expanded. The other is that W. R. Grace & Co. and Farbwerke Hoechst, A. G. Frankfurt/Main-Hoechst of Germany will erect a low-pressure polyethylene plant near Sao Paulo. Hoechst is the company which first worked on Ziegler-type polyethylene in Germany and will furnish know-how to Grace. The same German company has similar arrangements with Hercules in the United States. Grace also has a license to produce Phillips polyethylene in the United States, but no production plans have been announced.

Variation in polystyrene. A medium-flow, medium-set-up polystyrene molding material, called Lustrex Hi-Flow 66, has been added to Monsanto's line. It fits in between the company's regular-flow and soft-flow general-purpose compounds. It is suggested for use in moldings with both thick and thin sections.

Look to vinyl esters for new ideas. A new vinyl esters unit has come on stream at Carbide and Carbon's Niagara Falls plant. They were first made available four years ago in small quantity but are now in commercial production. Celanese Chemical has also announced that vinyl propionate is now available and that other vinyl esters will follow later. Carbide states that vinyl esters such as propionate, vinyl butyrate, and vinyl 2-ethylhexoate are particularly remarkable for their copolymerization possibilities with vinyl chloride, vinyl acetate, and other monomers. They can be used as internal plasticizers and thus minimize or lessen the need for conventional plasticizers. They contribute such properties as flexibility, washability, weathering, and adhesion. Paints, adhesives, and textile sizing materials are the first most likely application where the esters will upgrade or perhaps even outmode

*Reg. U.S. Pat. Off.

present resins. But the potential field is much broader; the vinyl esters may portend the day when vinyl resins will be tailor-made for every different application. More details will be given in the Plastiscope next month.

Licenses for low-pressure polyethylene. Phillips Chemical has licensed Societe Rhone-Poulenc of France and Societe Kuhlman in France, which companies will erect jointly a plant to produce polyethylene by the Phillips process. M. W. Kellogg, producer of Kel-F fluorocarbon resin, has also announced that it will become the fourth company in the United States to take out a Phillips license. The plant, to be erected in the Pasadena area near Houston, Texas, with a starting capacity of 25 or 30 million lb., is scheduled to go on stream in late 1957. The other three United States licensees for Phillips polyethylene are Bakelite, Grace Chemical, and Celanese.

Wide polyethylene film. Gering Products, Inc. is now selling moisture-vapor barrier polyethylene film in widths up to 20 ft. and in thicknesses of 0.002, 0.004, 0.006 in. and heavier. Black or transparent are available. It is designed primarily for the building trade.

Aqueous nylon. Genton is the name of an interesting dispersion made up of 90% water and 10% Zytel 61 resin. Simple evaporation of the water will leave a satisfactory film, but if good adhesion to metal is desired, a fusion temperature of 309 to 350° F. is suggested. It may be possible later to produce free film or to produce a laminate skin by this method, but at present the process is suggested for fabrics or yarns. It prevents wool, cotton, or nylon thread from raveling; helps prevent runs in nylon hosiery; protects the surface of cotton seat covers; and strengthens unwoven or felted material, giving them somewhat the resiliency of nylon fabric. General Dispersions, Inc., 165 Third Ave., Paterson, N. J., is the producer.

Monomer of the year. A European visitor surveying the vinyl industry in the United States recently stated that in his opinion Carbide and Carbon's new Monomer MG-1 was the outstanding development of the industry in 1955. Its greatest initial use is to make plastisols hard. Hitherto, products produced from plastisols have been limited to soft or flexible end products. Vinyl foam producers also claim MG-1 will eventually make practical the production of 2 to 4 lb./cu. ft. flexible foam. Other potentials for MG-1 include copolymer uses. It is a member of the acrylic family. As a monomer it is not volatile as styrene, butadiene, and most other monomers—is more comparable to D.O.P. for volatility. When used with a catalyst in a vinyl formulation, it polymerizes or cures during fusion to a hard resinous material which retains no plasticizing action, making it possible for plastisol compounders to produce a product with any desired degree of hardness.

Cycolac expansion. Borg-Warner, parent company of Marbon Chemical, has appropriated $10 million to build a chemical plant for production of Cycolac at Washington, W. Va. Marbon has never released information on the make-up of Cycolac, but in the trade it is generally considered an acrylonitrile-styrene type of resin. Marbon lists it as a high-impact thermoplastic resin applicable for the usual end-product in that classification. Claims are also made that pipe made of Cycolac will withstand hundreds of pounds pressure.

Foundry resins. Interest in synthetic foundry resins for both shell and core moldings has taken on added impetus over the last year. Phenolic resin for shell molding has exhibited slow growth but is showing more life as more foundries change over to the new equipment required—total volume is still expected to be 50 or 60 million lb. by 1960. New varieties are now being tested. One is a coating of resin applied to each grain of sand. But freight costs for shipping sand are high. Consequently, resin producers are developing ways in which

(To page 39)

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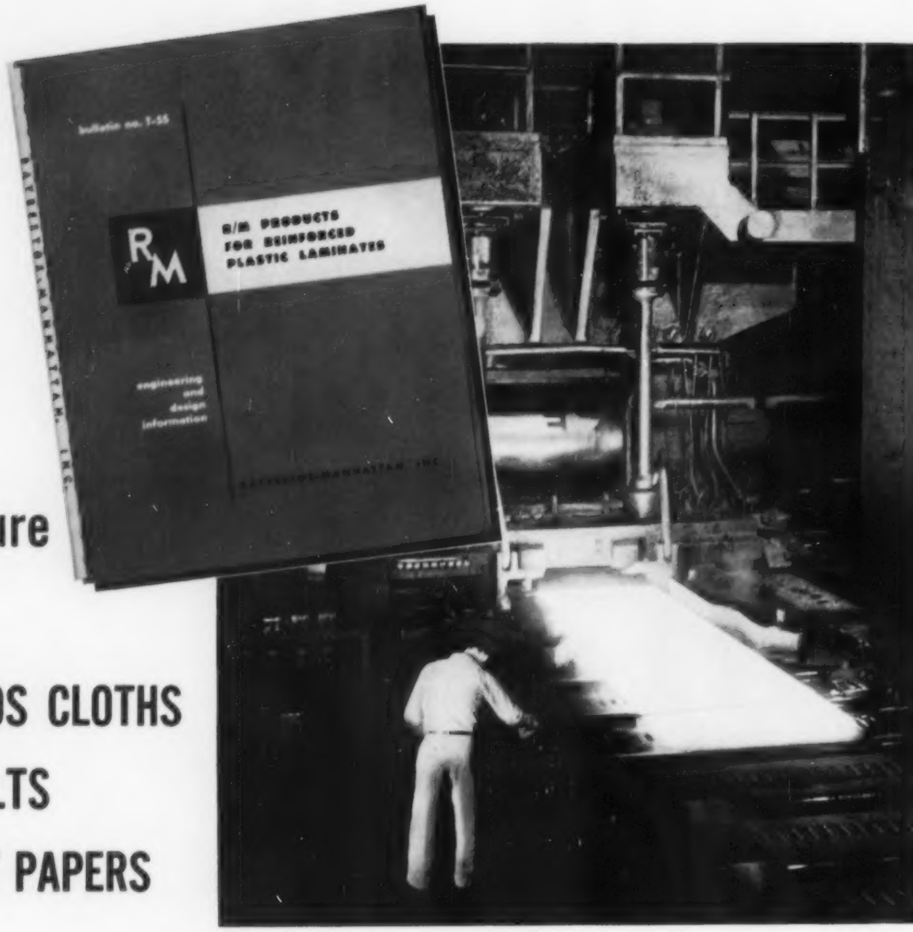

EXAMPLE

It describes, for example, R/M Style 14P166 Asbestos Cloth recommended for reinforcing plastic laminates that must withstand terrific bearing stress loads. You learn that this is an A.S.T.M. grade AA asbestos cloth that guarantees a minimum of 90% asbestos and the lowest organic content consistent with a practical pound cost. A balanced texture of 14 ends x 14 picks provides equal physical properties in the warp and filling directions, without necessitating cross laminating. The soft spun yarns facilitate thorough resin impregnation, and provide physical properties in the finished laminate superior to the developed properties of one made from the same yarns with a normal hard twist.

CONTAINS TECHNICAL AND DESIGN DATA

R/M Bulletin No. T-55 and supplemental Technical Data Sheets present useful fundamental information for high and low pressure laminators. The data presented should suggest new uses and markets to you for scientifically engineered plastic products.

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The Plastiscope

the foundryman can do his own sand coating. One is a cold process for applying the resin; another is a hot melt process which would supposedly give better distribution. Any of the coated sand methods require less resin than the conventional dry powder mix.

Core resins. This branch of the foundry resin business is also on the upswing. Liquid phenolics have been used for years, but the new resins for coating sand mentioned above are also applicable to cores with the advantages that the resins can be cured in the hot core box instead of moving the cores to a baking oven. Urea is also an old timer for core binding in which there is a new interest, especially for use in dielectric ovens. Goodrich Chemical introduced a new liquid core resin, Good-rite CB-35, last summer which is claimed to offer advantages in gas formation, collapsibility, and resistance to "overbaking." Hercules is distributing what is said to be a type of Vinsol called Truline for core resins. It is a dry resin and will bake out 25% faster than oil-bonded cores.

A different polymeric plasticizer. Harflex 300, recently introduced by the Harchem Div. of Wallace & Tiernan, Inc., is described as an easy processing, permanent plasticizer for vinyls. The "easy processing" is mentioned as its most outstanding characteristic. Harchem asserts that Harflex can be used as a sole plasticizer, eliminating the need for monomeric plasticizers which may later spew or migrate. It is claimed that the new plasticizer is "unique" among permanent plasticizers for dry blending and that it will eliminate or minimize Banbury or roller mixing.

Decision on bottles expected. The Federal Court is soon expected to make another decision in the squeeze bottle industry. Observers say that the court will find the plaintiff's patents valid but will find no infringement of these patents by the defendant company, which has worked out its own method of fabricating plastics bottles.

Association changes name. Vinyl Fabrics Institute is now the official title of the former Plastic Coatings and Film Association. The group was first organized in 1927 by nitrate and rubber coaters. The name was changed to emphasize "vinyl," now the chief coating material used by members and because the word has become well established in automotive and house furnishings advertising. The word "Institute" was adopted because of the group's activities in such areas as standard tests, collection of traffic and production data, etc. Officers for 1956 are: S. Ernest Kulp of Masland, president; Fred L. Ford of Athol, vice president.

100-plus Durometer plastisols. Munray Products of Cleveland have announced ultrahigh Durometer, high strength plastisols called Rigo-Plas. Such "hard" plastisols can be used for toilet seats, toys, manikins, automotive, and appliance applications. They permit use of thinner walls in many products now made of soft plastisols. They can be rotationally cast in shapes that are now injection molded or vacuum formed.

More epoxies. Jones-Dabney Div., Devoe & Raynolds Co., Inc., have broadened their resin production activities to include all types of epoxies in addition to the resin they have been making for protective coatings since 1947. A plastics technical laboratory has been set up

which will devote its entire time to the formulation of epoxies for adhesives, coatings, potting, laminating, encapsulation, and other uses. Other synthetic resins will also be studied. General resin production by Jones-Dabney is carried on at Newark, Los Angeles, and Louisville. Geo. V. Jenks is director of technical service for the plastics section and Dr. Harold C. Cooke will work with him. Jones-Dabney and Ciba are the original owners of the epoxy patents. They licensed Shell Chemical and Bakelite, both of which have been in production for several years. Dow Chemical, producer of bis-phenol, one of the ingredients used in epoxy production, is reported to have negotiated for a license but has made no announcement concerning future plans.

Kralastic expansion. Naugatuck Chemical Div., U. S. Rubber Co., has acquired a 150-acre tract near Baton Rouge, La., to construct a new plant for production of Kralastic, which is based on styrene, acrylonitrile, butadiene, and nitrile rubber, and is used for pipe and in Royalite sheeting material. The new plant, scheduled for completion by July 1957, will cost over $5 million and will more than double the production capacity of present facilities.

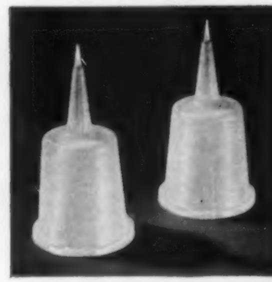
Buttons. Manufacturers of rented garments, such as uniforms for waiters, are turning to melamine buttons because they are strong, hold their luster, and are not affected by strong alkalies in wash water. One company has also designed its buttons so that both faces are identical—when pressure from an iron is applied, the button won't break. But urea buttons are still supreme in women's wash dresses and youngsters' clothing and ocean shell is still a favorite in higher cost men's shirts, with polyester buttons moving into the medium and lower cost men's shirt line. The shell buttons made from river clams have suffered from plastics' competition, but there is evidence that the producers of shell buttons have moved into the plastics molding business.

Melamine capacity increase. Monsanto is modifying its chemical melamine facilities at Everett, Mass., to permit increased production. Monsanto melamine is used for decorative laminating, surface coating, and textile and paper treatment.

Sprayable plastisols. Two companies are offering new plastisol formulations that can be sprayed at 100% solids and are characterized by high-gloss surfaces when properly applied and cured. Stanley Chemical Co. is offering two types that, even when sprayed on vertical surfaces of cold metal, will not run or sag. One type, available in a range of colors, is for film thicknesses of 10 to 15 mils and is recommended for coating parts for washing machines, dishwashers, etc. The second, supplied in black, is for coatings 50 to 60 mils thick and is designed for heavy-duty use such as lining chemical tanks, tank cars, and similar equipment. Michigan Chrome & Chemical Co. announces a plastisol that can also be sprayed as received and that can produce films up to 60 mils thick in one application without sagging. Multiple coats can be obtained with only a short cure between sprayings. It is also proposed for heavy-duty purposes, is reported to exhibit outstanding adhesion to metal surfaces, and is available in colors.

Consolidation of molding and merchandising units. Tri-State Plastic Mfg. Co., Evansville Merchandise Co., Empire Warehouse Co., Tri-State Molding Co., Inc., and its subsidiaries, Tri-State Die Casting Corp. and Plastic Block City, Inc., have been purchased by Patrick J. Buckley, Chicago, who was one of the founders 14 years ago. Tri-State Molding has three plants at Henderson and Owensboro, Ky., and sells toys through the Plastic Block subsidiary in Chicago. The firm employs more than 300 persons and turns out over 1 million boxes per month for packaging. Tri-State claims to be one of the largest, if not the largest, users of polystyrene in the United States.

For additional and more detailed news concerning the Plastics Industry, see p. 256.



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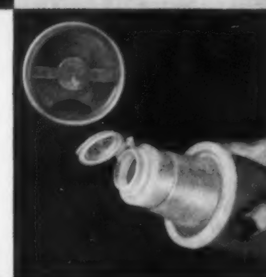

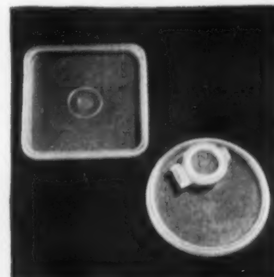

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The logical molder for you to consult regarding that product or package of yours which is to be made of polyethylene is Tupper. Tupper has done more than any other molder to make molded polyethylene a practical reality.

Aside from having designed, patented, and promoted successful seals, closures, and dispensers for polyethylene containers, the Tupper Corporation has vast experience in *every phase* of polyethylene packaging and polyethylene injection molding. This experience will be of major importance in improving your product, in reducing your costs, when Tupper goes to work for you.

Tupper's combination of experience, technical ingenuity, and the most modern equipment is at your service for the custom molding of your product in polyethylene. You can do no better than the best ...and the best at molding polyethylene is Tupper!

When equipped with Tupper Seals, Tupper Canisters, Sauce Dishes, Wonder Bowls, Cereal Bowls and Funnels in various sizes are the most versatile reusable containers you have ever seen.

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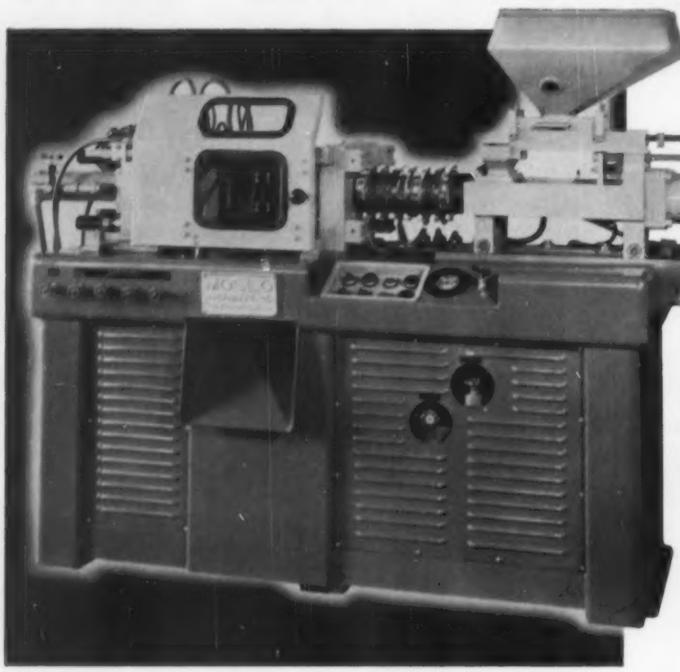
CONTAINER MOLDING IS "Duck Soup"



WITH A MOSLO INJECTION MOLDING MACHINE

The Moslo Model 74 Super 2-ounce injection molding machine is the last word for molding containers.

Especially designed and engineered to fit the needs of the container industry, this high-speed, fully-automatic machine will mold thin or heavy wall sections from a single or multiple cavity mold.

The best way to fully appreciate a Moslo machine is to come in for a demonstration. Bring your own molds and we will gladly show you the way to make container molding as easy as "Duck Soup".

COMPARE THIS FOR PRODUCTION

Illustrated at the right is a polystyrene dish produced on a Moslo Super 2-ounce machine. Seven hundred and twenty (720) of these 6-ounce dishes were shot per hour from a single cavity mold. Specifications are:

Wall thickness	.025"
Top diameter	4"
Bottom diameter	3.072"
Depth	1⅛"
Weight	12.5 grams

The MOSLO line includes these models, ideally suited for container molding.

Model 74-7 –Super 2 ounce with 7" mold stroke
Model 74-12–Super 2 ounce with 12" mold stroke
Model 75-8 –High speed 3 ounce with 8" mold stroke
Model 75-15–High speed 3 ounce with 15" mold stroke
Model 76-8 –Super 3 ounce with 8" mold stroke
Model 76-15–Super 3 ounce with 15" mold stroke

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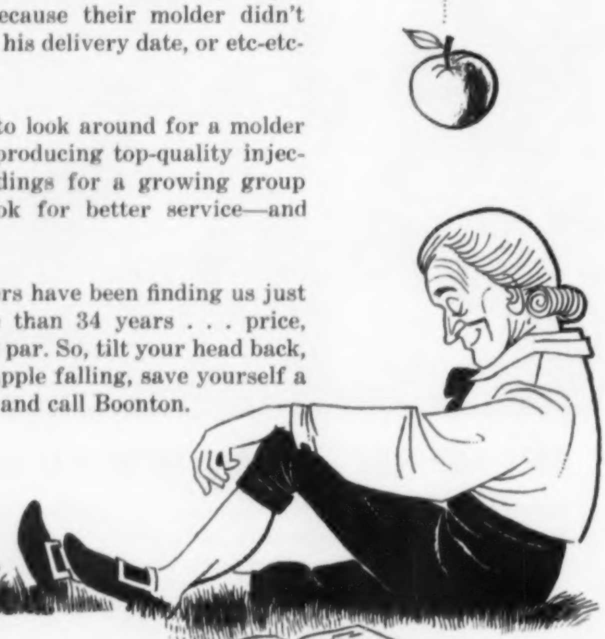

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length, 34½"; width, 30";
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MODEL 1A-1
1 HP., throat 3¾" x 5"
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Sales Representative

Screw caps for toothpaste tubes are being made from "Poly-Eth" 1007 by a Chicago molder specializing in closures. Advantages are a good tight seal, no liner is needed and colors are non-bleeding. Polyethylene liners for other closures give superior protection due to the excellent resistance to chemicals and deterioration. And, with proper design, they stay in place without gluing.

A Chicago processor has successfully extruded polyethylene into a three-finned divider which is cut into 8" lengths and fits a 4" diameter jar. The jar is then filled with alcohol for compartmental storage of medical instruments, sutures and test tubes.

"Poly-Eth" 1007 is being used for walled tubing for which precise dimension, good finish, good dry-coloring and high extruder output are important.

Warp-free container lids with good finish and clarity have been molded on fast cycles by several firms using "Poly-Eth" 1008.5. ...Excellent dimensional control and glossy finish on a black auto part were obtained by a Michigan molder using "Poly-Eth" 5015.

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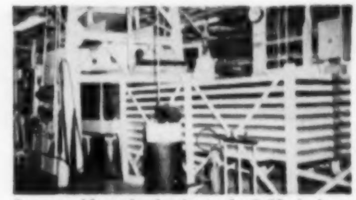

Press used for nylon laminates for B-52 airplane parts at Swedlow Plastics Company

Nylon fabric helps keep America's global jet bombers flying

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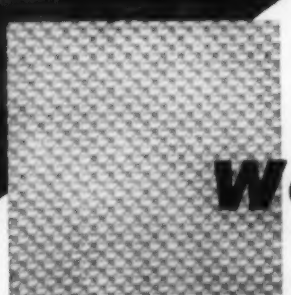

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For Coated Materials, High and Low Pressure Laminates and Other Reinforced Plastic Products

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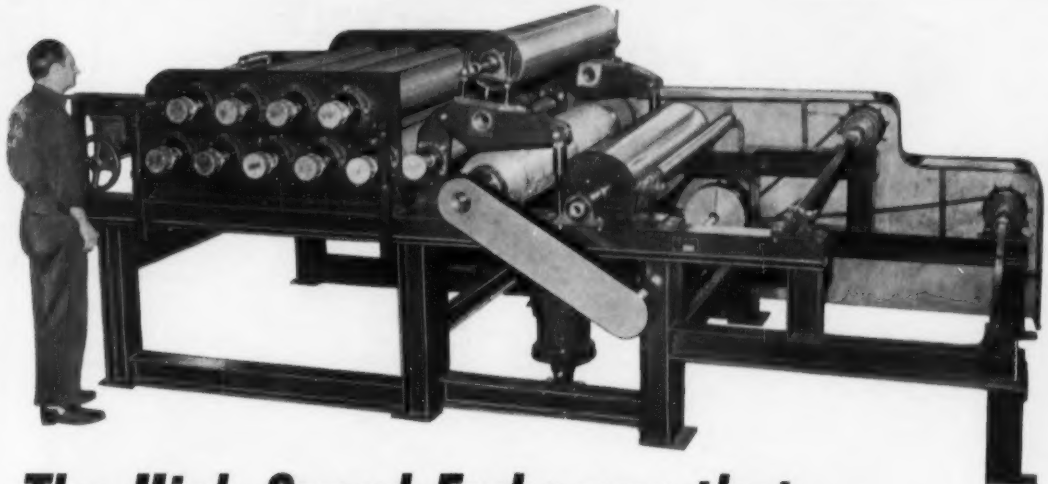
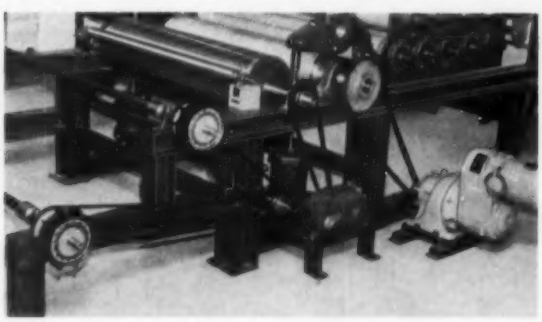
Meet the All-New Liberty 10



The High Speed Embosser that

Actually Thinks!

Illustrated is the variable speed main drive with 7:1 ratio as well as PIV Link Belt system which automatically controls embossing speed.



AUTOMATION is often a bird flying too high and too fast to identify clearly. But you will quickly identify this all new LIBERTY 10 as the epitome of completely automatic film embossing.

Here's why!

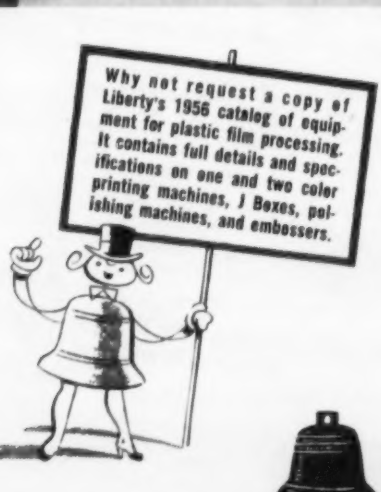
This new embosser operates on a Link Belt PIV system (see illustration at left). It is equipped with air pneumatic tension clutches that prevent the web from being pulled and stretched. As soon as tension hits the sensitizing roll, the clutch automatically engages at the proper pre-set tension and the web is moved at the proper rate.

In addition, the LIBERTY 10 has a positive variable speed control between the embossing head, heating system and cooling drums—another guarantee that your film will be embossed at the proper pace without stretch.

Now—what about speed?

The LIBERTY 10 is equipped with 10 electrically heated rollers. This means your material is conditioned for embossing faster—it can travel through the embosser at an amazing speed of 35 yards per minute.

And as far as cost goes, if there were a comparable machine on the market today, the LIBERTY 10 would still be priced lower. If you're embossing plastic film or coated fabrics, this is an important development you can't afford to overlook. Why not write today for more complete details and price on the new LIBERTY 10.



LIBERTY MACHINE CO., INC.

275 Fourth Avenue · Paterson 4, New Jersey · SHerwood 2-5565

U.S.I. POLYETHYLENE PROCESSING TIPS

Tailormade resins, a trend for the future

The nation's leading industrial forecasters predict a polyethylene consumption of 850 million pounds for 1960 — with the billion-plus pound per year goal only a few years away. Although much of this increased production will be consumed by end-products already on the market, many new applications and new developments are expected to arise with the increased availability of polyethylene resin.

Polyethylene molders and extruders, long accustomed to working with a limited number of polyethylene types, will exercise increasing influence over the properties of the basic resin. Resin suppliers will work more and more closely with the converters, especially manufacturers of new products, to supply them with resins having the best possible properties for each new application. This is a trend already well established.

For example, here are a few of the 25-35 PETROTHENE® resins and variations that have already been tailored to specific processing situations and new end-use applications.

1. INJECTION MOLDING: Molders want high flow for maximum production, high gloss for appearance, and a choice in degree of flexibility. PETROTHENE 202 and 203 have been tailored for large shot moldings; 200 and 201 for smaller shots and multiple cavity dies.

2. FILM: PETROTHENE 110 and 210 are tailormade for blown- and flat-film extrusions. Degree of slip can be controlled to meet customer requirements. PETROTHENE 213 has been selected in specific cases for transparency, hand and high production rates.

3. PAPER COATING: Converters want good adhesion, high production rates, resistance to hot-melt oxidation, no odor. PETROTHENE 203 has been tailormade to fit these specifications. It has been accepted by the pulp and paper industry as an improvement in paper-coating raw material and is gaining in popularity for this vital and expanding application.

4. ELECTRICAL: The wire insulation manufacturer requires polyethylene that gives stress-crack resistance, low deformation under load, and good all around electrical characteristics. PETROTHENE 300 series has been tailored to these end-use requirements. Type and quantity of antioxidant and color are specified by the customer or by the electrical specification code number.

5. BLOW MOLDING: Cube-to-cube uniformity, hot-melt elasticity, clarity — all essential properties for this critical application — have been built into PETROTHENE 201. Other PETROTHENE types have been used in some cases for blow molding because of customers' unusual processing techniques.

6. EXTRUSION: PETROTHENE 560 (black) was designed to give good burst strength, high gloss and high extrusion rate for pipe manufacturers.

7. SPECIALTY APPLICATIONS: Requests come in for special properties, special forms. U.S.I. has tailored each resin type to fit customer requirements so as to help the converter reach mass production and enjoy greater economies. Thus the converter can obtain his full share of profits from this forecasted billion pound market.

SUGGESTED PETROTHENE® RESINS

Application	PETROTHENE No.
Blow Molding	201
Electrical	300 Series
Film	110, 210, 213
Injection Molding	
Large Shot	202, 203
Small Shot	200, 201
Paper Coating	203
Pipe extrusion and misc.	560 (Black)

Do you need a special resin?

If your polyethylene product requires special properties, either in the finished part or during processing, why not call on U.S.I. for assistance. Experienced Technical Service personnel will work with you on every phase of your problem. A U.S.I. PETROTHENE resin, already developed for a similar application, might be just what you need. If not, depending upon the quantity involved, a special resin, tailored to your needs by U.S.I., might provide the answer.

Tomorrow's prices will encourage new uses

Today's costs of producing quality polyethylene resins are relatively high and constant, but experts feel that as producers improve quality and increase production, lower selling prices will follow. New products, now undreamed of, will be developed within the next few years to utilize the large available volume of this versatile plastic.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers Products Corporation
99 Park Avenue, New York 16, N. Y.
Branches in principal cities

NEW, DIFFERENT, DEFINITELY SUPERIOR...

PITTSBURGH 508 PREFORM ROVING

All of our molding customers who have tried Pittsburgh's new #508 roving report excellent results. That's because PPG #508 really "outperforms" other known types of roving in producing consistently better preforms.

PPG #508 Preform Roving is definitely superior because it has been treated by a special sizing process to insure better chemical and mechanical bond between glass fibers and molding resin. Results: consistently high quality moldings, lower scrap rate, faster preforming.

Check out PPG's new 508 Preform Roving on your own molding jobs and see the difference. You can get complete information on standard packages and available sizes by simply contacting our executive offices or our district sales offices in Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, New York, Philadelphia, St. Louis or Los Angeles. Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.

FIBER PPG GLASS

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PITTSBURGH PLATE GLASS COMPANY

the name to watch in petrochemicals

Petro-tex came actively into being in April, 1955 with the acquisition of the facilities of the Government's Houston butadiene plant. Today, more than 50% expansion of capacity is well along to keep pace with the surging demand for rubber and to provide a surplus for new butadiene applications.

Alertly manned with experienced personnel and constructively at work on new markets, Petro-tex is the name to watch in butane-derived petrochemicals. We will welcome the opportunity to discuss your needs.

Petro-Tex

PETRO-TEX CHEMICAL CORPORATION

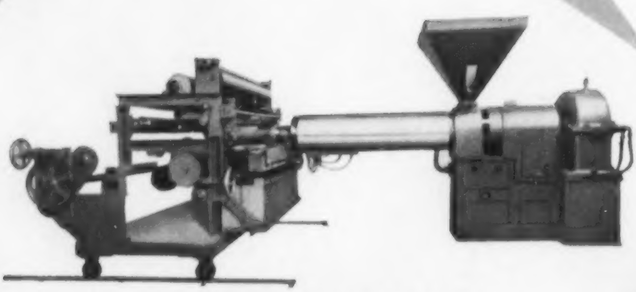
HOUSTON 1, TEXAS

A JOINT ENTERPRISE OF

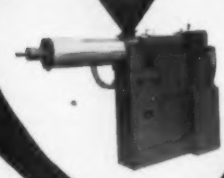
TENNESSEE GAS TRANSMISSION COMPANY AND FOOD MACHINERY AND CHEMICAL CORPORATION

extruders by *Egan*

From 2" Thru 8" with screw lengths of 16 or 20 Diameters. • Hard corrosion resistant liners. • Heavy duty thrust and radial bearings with force feed lubrication. • Completely prewired temperature control cabinet. • Screw speed tachometer. • Precision ground screws. • Large feed hopper with sight glass and cut-off slide. Complete installations for film, sheet, pipe, shapes.



A COMPLETE INSTALLATION FOR FILM
With 4½" Extruder • Improved "T" Type Die and New Heavy Duty Haul-off Unit.



Delivery From 3 Weeks

Our new plant in Somerville, N. J. with increased facilities enables us to offer prompt delivery on most sizes of extruders.

Write or Phone Today For Complete Information—No Obligation.

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Designers and Builders of Machinery for the Paper Converting and Plastics Industries

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4 reasons why production of ATLAC® polyester resin *has doubled*

LIKES FORMULATING FREEDOM

"It's a cinch to mix resin to the consistency I need for every job. All I need do is adjust the ratio of monomer to get any viscosity from 500 to 6000 CP."

—Production Supervisor

SWITCHES MONOMERS

"With ATLAC 382, I don't have to be tied to a single monomer. When I want different properties, I can use cross-linking monomers of my choice, or a combination of several. That's one of the big advantages of a dry resin—you can mix it as you please."

—Design Engineer

GETS SPECIALTIES EASIER

"Many of the pre-mixes I make are for high impact strength. I can upgrade conventional resins by adding ATLAC 382. It's easy to get what I'm looking for, and I can adjust the formula any time to match other jobs going through the shop."

—Pre-Mix Supplier

MAKES CHEMICAL-RESISTANT SPECIALTIES

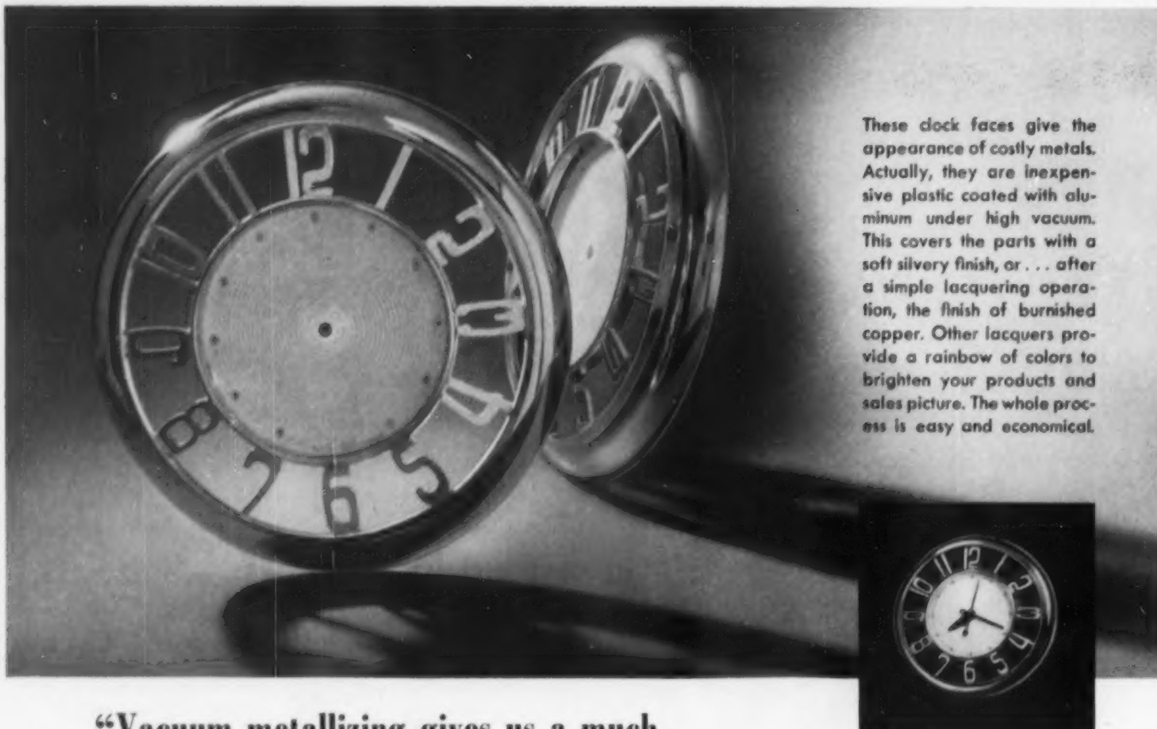
"There's been a lot of demand lately for special moldings that can stand up in alkalies, acids and organic solvents. I've licked a lot of these problems by formulating with ATLAC."

—Specialty Molder

. . . Write to Atlas for data and samples.

CHEMICALS DIVISION
ATLAS POWDER COMPANY
WILMINGTON 99, DELAWARE

In Canada: Atlas Powder Company, Canada, Ltd. Brantford, Ontario, Canada



These clock faces give the appearance of costly metals. Actually, they are inexpensive plastic coated with aluminum under high vacuum. This covers the parts with a soft silvery finish, or . . . after a simple lacquering operation, the finish of burnished copper. Other lacquers provide a rainbow of colors to brighten your products and sales picture. The whole process is easy and economical.

"Vacuum metallizing gives us a much wider market for our molded plastics and additional profit for the operations performed after molding."

W. C. Conroy, Sales Manager
Plastics Division Erie Resistor Corporation

Erie Resistor Corporation, Erie, Pa., uses a battery of *CVC* vacuum coaters to give inexpensive plastic parts the rich finish of costly metals.

Coating parts with aluminum under high vacuum and applying various lacquers can give them the attractive appearance of gold, silver, copper, or a whole rainbow of other metallic colors.

The two clock faces shown above, for example, have the soft sheen of burnished copper and silver. Stringent tests (see below) show that the metallized finish is durable. Rough usage leaves its color and shine unmarred.

Vacuum metallizing is simple and inexpensive. A few hours training makes any of your help expert in the metallizing operation. Just a few ounces of aluminum covers thousands of parts. The process works as well with basic metals as with plastics.

You are welcome to share our experience in high-vacuum metallizing and associated lacquering operations.

We will be glad to discuss any particular applications with you.

Tests used by Erie Resistor on the metallized finish of the clock faces:

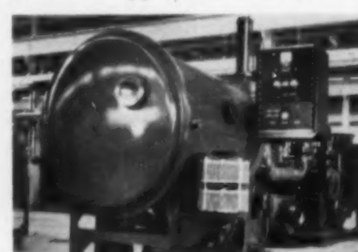
Scratch test. Cut cross-hatched lines approximately $\frac{1}{16}$" apart with sharp tool. Stick clear adhesive tape over the surface. When tape is removed, finish should remain on part.

Temperature shock. Place parts in 140° F. oven for two hours. Remove and place immediately in −20° F. cold chamber (air).

Humidity test. Expose parts to 120° F. for two hours and then to 92% R.H. at room temperature (86° F.). Four cycles of this exposure.

Fading test. Expose samples to ultraviolet light for 100 hours using a Corning 5" DCVX RDL-type filter with a G.E. 1000-watt, RH-4 mercury vapor lamp located 7" from the samples. No fading or discoloration should occur.

The above tests should not cause any observable change in the finished parts.



This 48" vacuum coater is one of three CVC production coaters used by Erie Resistor. Smaller sized models also available from CVC provide economical operation for short production runs. We deliver these units with all necessary equipment and controls—ready to install.

CVC

Consolidated Vacuum, Rochester 3, N. Y.

a division of CONSOLIDATED ELECTRODYNAMICS CORPORATION, *Pasadena, California*

Sales Offices: Albuquerque • Atlanta • Boston • Buffalo • Chicago • Dallas • Detroit • New York • Palo Alto • Pasadena • Philadelphia • Seattle • Washington, D. C.

For Plastics — go to Worbla

Manufacturers of plastics for over thirty years.

WORBLA-PLASTICS have proved their worth

So that you may see for yourself — we shall gladly provide you with samples.

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Celluloid in sheets, tubes and rods.

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Cellulose Acetate in sheets, tubes and rods.

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Acetate powder for injection molding and extrusion.

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PVC (Polyvinylchloride) in calendered and pressed sheets, tubes, rods and profiles. Compounds for injection molding and extrusion.

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Nitrocellulose for lacquers and technical uses.
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WORBLA LTD.
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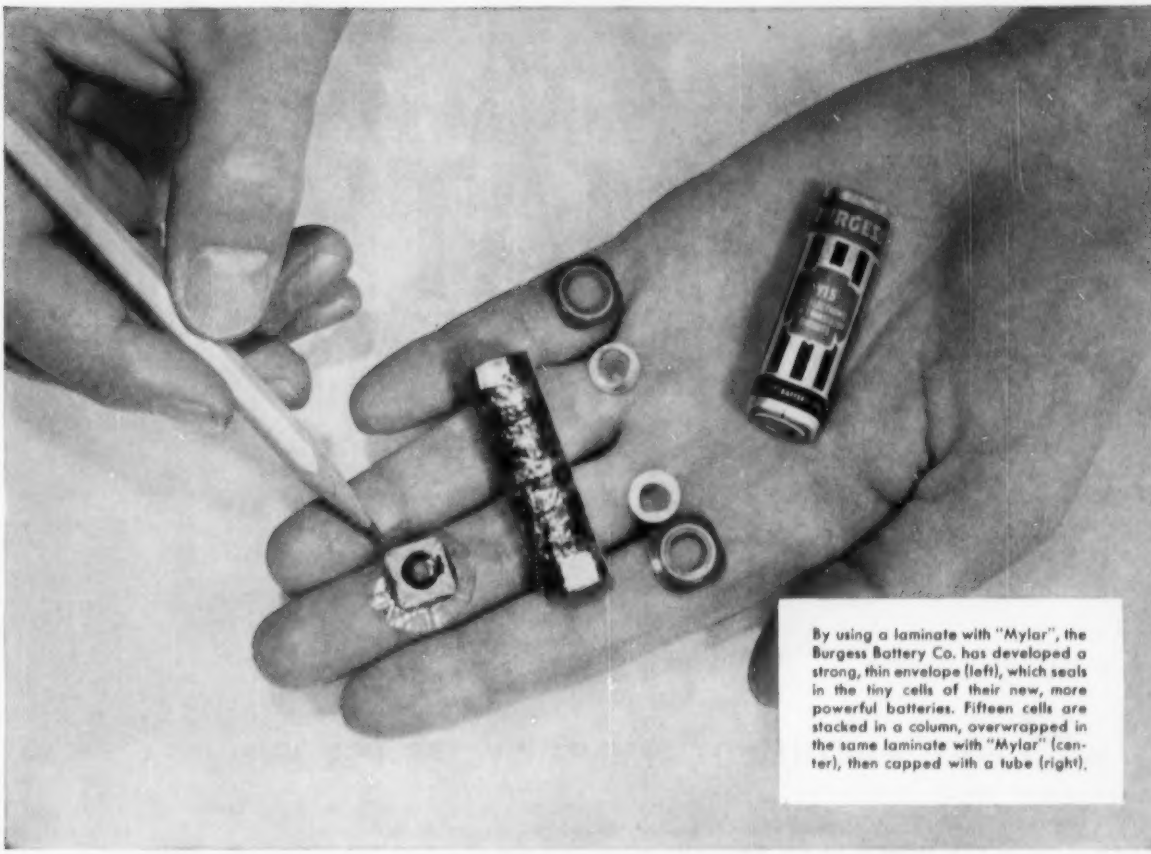

By using a laminate with "Mylar", the Burgess Battery Co. has developed a strong, thin envelope (left), which seals in the tiny cells of their new, more powerful batteries. Fifteen cells are stacked in a column, overwrapped in the same laminate with "Mylar" (center), then capped with a tube (right).

Du Pont MYLAR® helps Burgess obtain smaller, more powerful batteries

"Smaller than your finger tip, yet a third more powerful than conventional cells . . . that's the story of improvement on our line of dry-cell batteries", reports the Burgess Battery Company, Freeport, Ill. "We achieved this improvement by using a laminate with 'Mylar'* formed into an envelope to seal in tiny dry cells. Because the lamination is extremely thin, we saved valuable space for more energy-producing materials.

"By using this same laminate with 'Mylar' as the insulating cell-stack wrap, the old problem of holes appearing in the overwrap after heat sealing has been completely eliminated. High chemical resistance and strength make it possible to heat-mold each cell into a permanent locked position to preserve the intercell connection. What's more, the transparent material permits maximum quality control . . . inspectors can see into each cell stack to insure perfect stacking and wrapping."

This is only one example of the way versatile Du Pont "Mylar" polyester film, used alone or in combination with other materials, is making possible superior performance for a variety of electrical products.

For more information on how "Mylar" can help you improve product performance, or solve knotty problems, send in the coupon below. Be sure to indicate the type of application you have in mind.

**Mylar is a registered Du Pont trademark for its brand of polyester film.*

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

DU PONT
MYLAR®
POLYESTER FILM

E. I. du Pont de Nemours & Co. (Inc.)
Film Dept., Room M3, Nemours Bldg., Wilmington 98, Del.
Please send the new booklet (MB-4) listing properties, applications and types of "Mylar" available.

Application________________
Name________________
Company________________
Address________________
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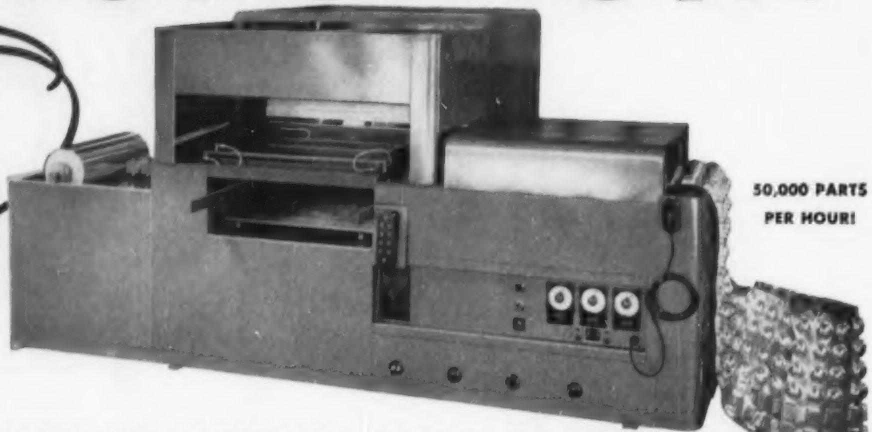
first with AUTOMATION!

ROLL-VAC
22
COMPLETELY AUTOMATIC
ROLL-FEED



50,000 PARTS PER HOUR!

3 FULL VACUUM FORMING CYCLES PER MINUTE!

Introducing the new ROLL-VAC-22, an all purpose drape and vacuum forming machine, capable of 3-4 complete forming cycles per minute. The continuous roll-feed uses standard rolls (up to 22" wide) of Acetate, Butyrate, Vinyl, Polystyrene, and others. All of these outstanding Auto-Vac developments, proven in the standard machines, are built into the new ROLL-VAC-22 – plus complete automation.

No operator is needed once the machine is set up and started. Die-cutting, filling or packaging operation can be synchronized into a continuous production line.

Where more versatility is required—where complex or larger shapes are to be formed—Auto-Vac vacuum forming machines are the obvious choice. They are the most advanced machines available.

Exclusive features include—automatic high-speed cooling for faster cycling • fully adjustable clamping frame, available with adjustable temperature control • lowest consumption uniform Hi-temp Calrod heater unit • heavy duty synchronized toggle action drape mechanism • adjustable drape frame height.

Auto-Vac machines are delivered fully equipped, complete units, ready to go to work. To help you establish and maintain the highest level of production, Auto-Vac will train your personnel at its own plant.

Pioneers!
Pioneers in the development and manufacture of the most advanced vacuum forming machines in the world.

Write today for further information and BULLETIN 55, which gives full information about Auto-Vac's standard drape and vacuum forming machines.

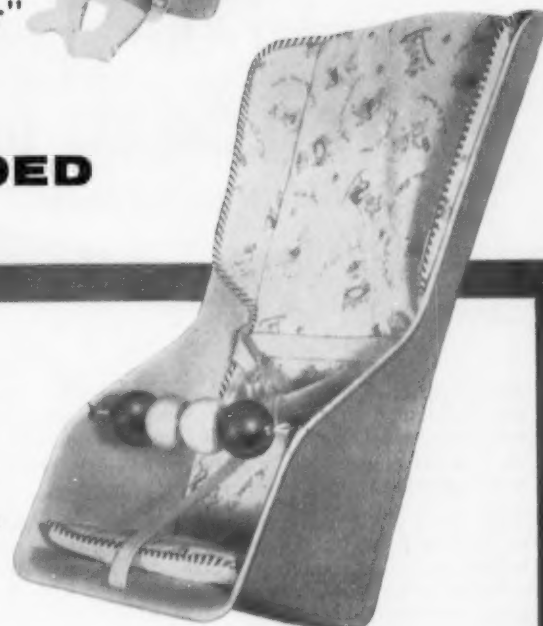
AUTO-VAC *Company* 1934 STATE STREET EXTENSION • BRIDGEPORT, CONNECTICUT • [illegible]

INFANSEAT*

"world's Best Baby Sitter"

NOW..

INJECTION MOLDED

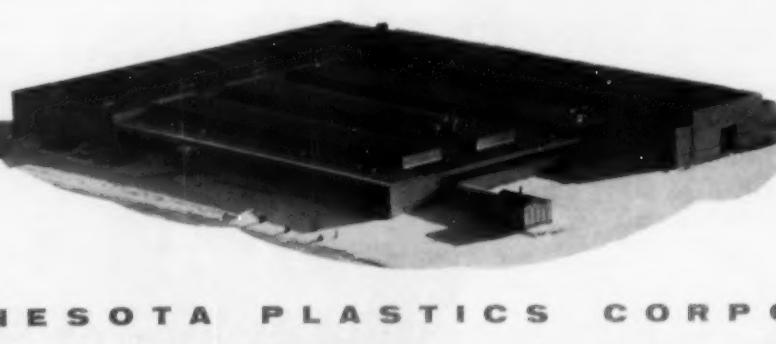


To meet increasing demand and to introduce improved design, durability and color appeal, without cost penalty, all of the facilities of our new modern plant were used.

Through the normal course of our complete development service, the original INFANSEAT was re-designed, engineered for injection molding and tooled. It is now molded, completely assembled, quality checked and packaged in a smooth conveyorized operation. Write or phone us if your organization can use these facilities and services to advantage.

*MANUFACTURED FOR
INFANSEAT INC.

Distributed by
THE TOIDEY COMPANY
FORT WAYNE, INDIANA



MINNESOTA PLASTICS CORPORATION

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You save when you order the sheet TAILORED to the job

1

This actually happened! A Nixon salesman in a customer's plant noticed pounds of Nixon formable sheet being trimmed and scrapped. "But why all this waste?" was his logical question. "Why not let us make the sheet to fit your job?"

Nixon helps to save you costly wastes, saves you valuable production time. Check your measurements carefully before you order. Nixon will make the sheet comply, wherever reasonable, or come so close you'll still be way ahead in time and savings.

This helpful service applies to all Nixon high quality formable sheet material, which can be supplied in a wide range of colors, gauges and sizes. Just one of the many services you can expect from one of the oldest, most reliable names in the plastic industry.

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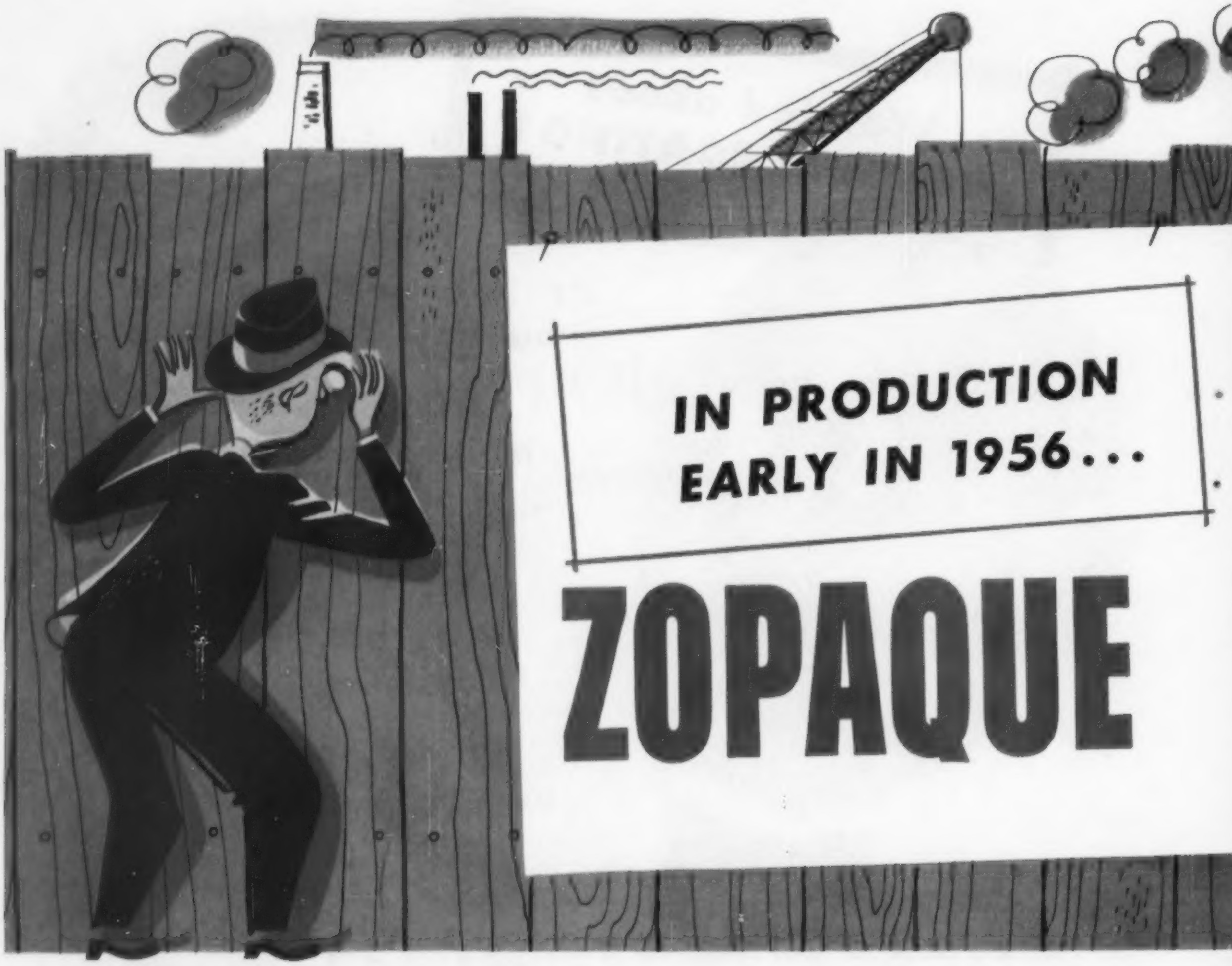
PLASTICS



First of 3 Big Expansions

TO GIVE YOU BETTER SERVICE WITH NEW ZOPAQUE, THE FINEST TITANIUM DIOXIDE

Glidden research has achieved greater whiteness and a highly accelerated dispersion rate in the new ZOPAQUE Titanium Dioxide. These developments combine to produce pigments with exceptional hiding power, outstanding gloss and color retention, and low reactivity. Early in 1956, Glidden will open its new plant and double its production of ZOPAQUE Titanium Dioxide. With this added production, Glidden will be in a better position than ever to serve your titanium dioxide needs.

Glidden ZOPAQUE Titanium Dioxide is available in both Rutile and Anatase grades.

Write today for more details on Glidden ZOPAQUE, the finest titanium dioxide.

Each Batch of Titanium Ore is Tested in Pilot Plant Before it is Processed!

You are looking at a giant titanium plant in miniature, as set up in the Glidden Laboratories in Baltimore. In this small-scale plant, jet-black titanium ore is transformed into gleaming white pigment through a hydrolysis process. This test provides an accurate check on every shipment of ore received by Glidden. It is part of the Glidden continuous quality control program to provide you with the finest ZOPAQUE Titanium Dioxide at all times.

THE GLIDDEN COMPANY

Chemicals — Pigments — Metals Division

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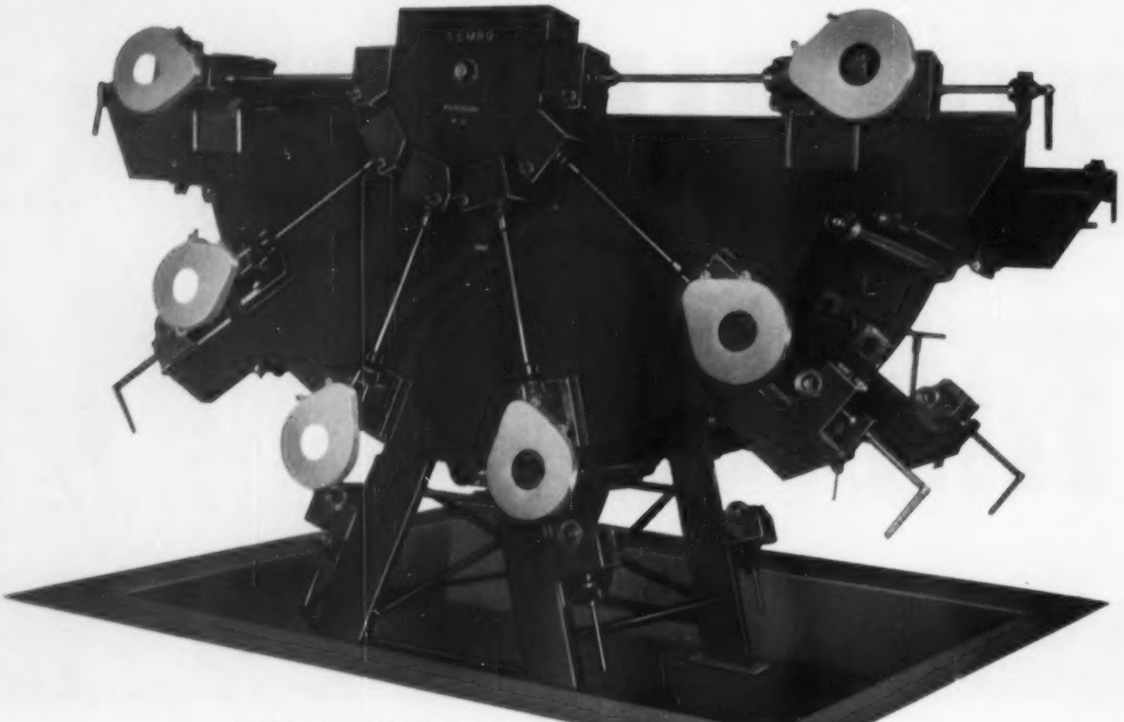
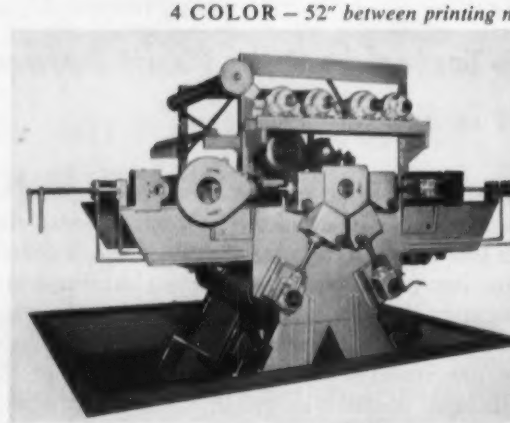
Quality Glidden Products

CUT DOWN SHUT DOWN
with LEMBO Rotogravure Presses



6 COLOR – 60″ *between printing nips*

4 COLOR – 52″ *between printing nips*



Hydraulic pressure on printing nips* permits operator to simultaneously back away all nips. The printing machine may be stopped, but the engraving rollers keep right on turning. Ink doesn't dry on rollers, so no wash-up is necessary. Result . . . shorter shut down time.

Printers of all unsupported and supported plastic film prefer fast, quiet, accurate Lembo Rotogravure Presses. The *web is carried* between impression cylinders—not pulled. This assures perfect, strain-free, in-register printing at speeds up to 125 yards per minute. Your choice of hand, motor or electric eye register control.

We invite you to see Lembo Rotogravure Presses in operation. Please write or telephone Lambert 5-5555.

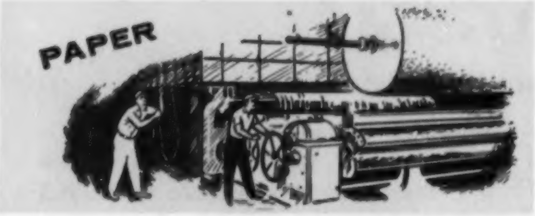
ROTOGRAVURE LEMBO L PRESS FLEXOGRAPHIC

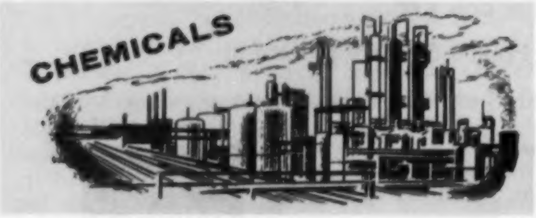
LEMBO Machine Works, Inc.

248 East 17th St., Paterson 4, N. J.
Manufacturers PRESSES · EMBOSSERS · LAMINATORS · ROLLERS

* Optional equipment available at extra charge.

Heyden FORMALDEHYDE helps in Industry's BIG JOBS...





It is interesting to note that further growth is predicted for the major products made from Formaldehyde. This applies, for instance, to phenolic molding and laminating resins—urea and melamine resins for textiles, paper and plywood—and various organic chemicals.

Heyden Formaldehyde is helping in this growth, as it has right from the original development of these products. Experience, gained through this long association with customer problems, has enabled Heyden to meet the most exacting needs of each use. As new applications arise, Formaldehyde with the proper specifications will be available from Heyden.

Both methanol-inhibited (N.F.) and methanol-free forms of Formaldehyde are supplied by Heyden. If this chemical is one of your raw materials, why not discuss your requirements with the Heyden sales office nearest you.

•

HEXAMETHYLENETETRAMINE

PARAFORMALDEHYDE

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CHEMICAL CORPORATION
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Chicago • Cincinnati • Detroit • Philadelphia • Providence • San Francisco

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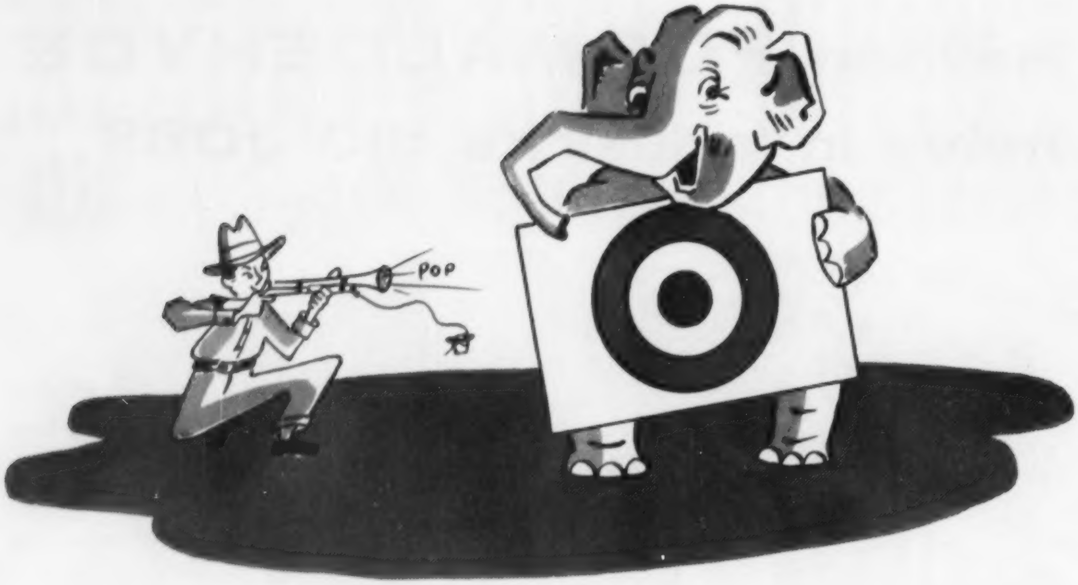
POP

Stabilized with Lectro "60", vinyl insulations pass immersion tests with flying colors.

Now "Dutch Boy" research brings you

Lectro "60"

unique stabilizer for vinyl insulation

- **Disperses with ease!**
- **Excellent electrical properties!**
- **Reduces volume cost!**
- **Repels water!**

Now it's here . . . in full production . . . a brand new lead complex. "Dutch Boy" Lectro "60".

Outstanding for water repellency. "Dutch Boy" Lectro "60" is insoluble and completely non-absorptive . . . actively repels water penetration. Prevents porosity. What's more, it demonstrates excellent volume resistivity over a wide range of temperatures. When TW and comparable vinyl insulations are stabilized with *Lectro "60"*, they pass immersion tests with flying colors.

Great ease of dispersion. "Dutch Boy" Lectro "60" resists penetration by water but welcomes plasticizer wetting — shows remarkable ease of dispersion. In vinyl insulation compounds, it shows excellent extrusion properties . . . no moisture pick up . . . no gassing. And with most plasticizers it is non-reactive. Excellent compatibility.

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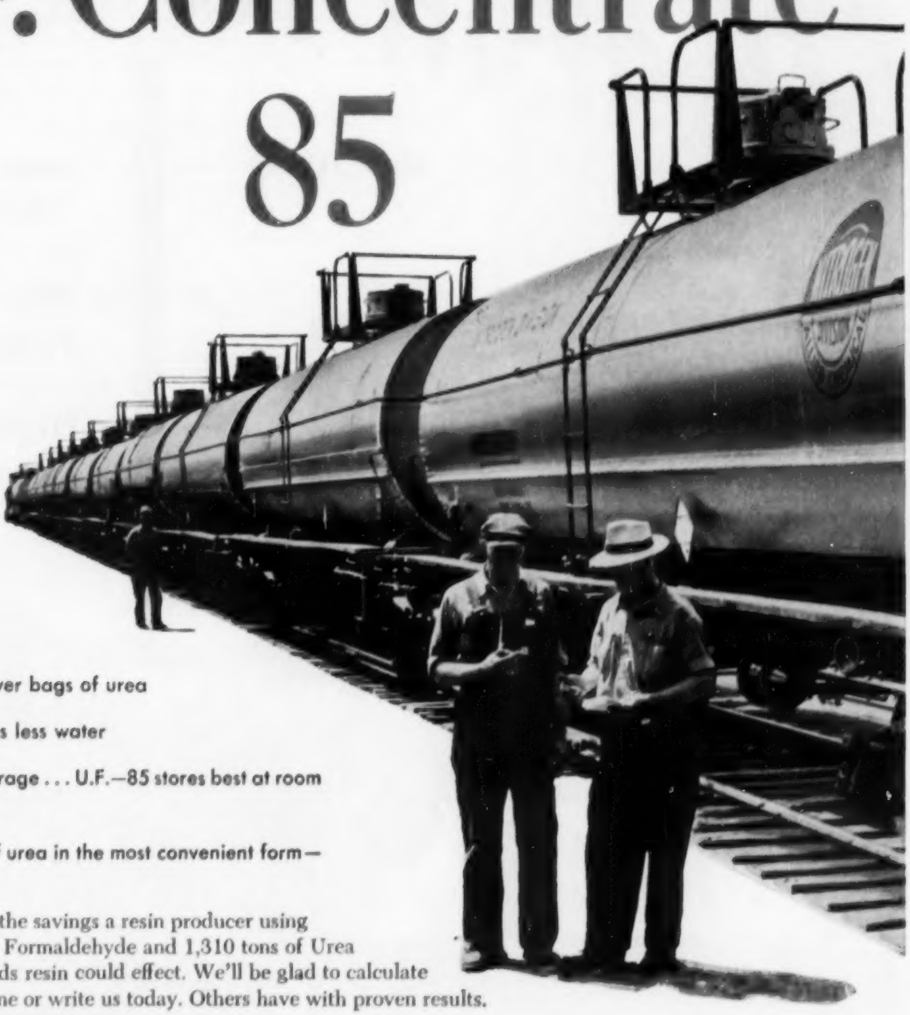

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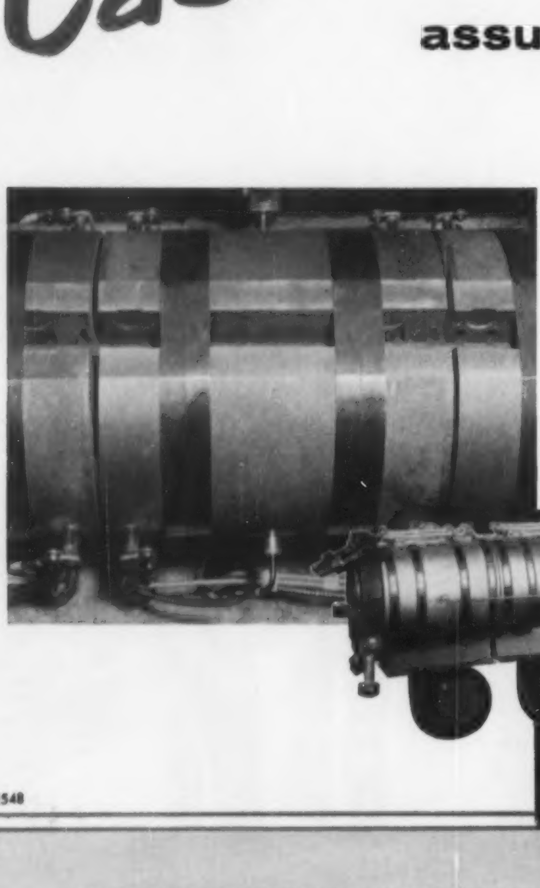

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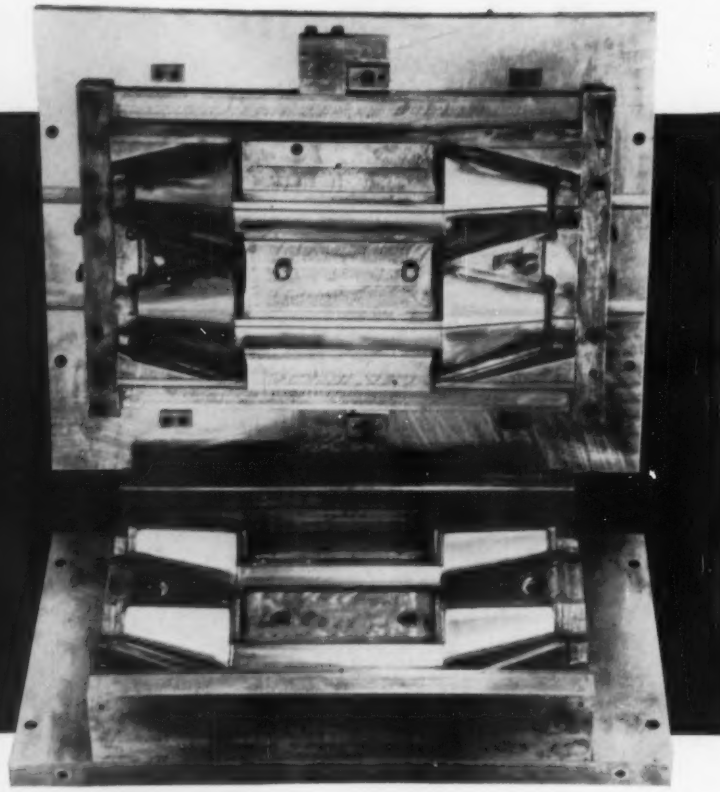

Speed Alloy Mold, Designed for Fiberglas Matting (the finished part shown at left)

Engelking Patterns, Inc., Columbus, Indiana, produced this mold with cavities of Speed Alloy Plate. This "time saver" steel was selected because of its excellent machinability, fine finishing characteristics and dependable response to flame hardening.

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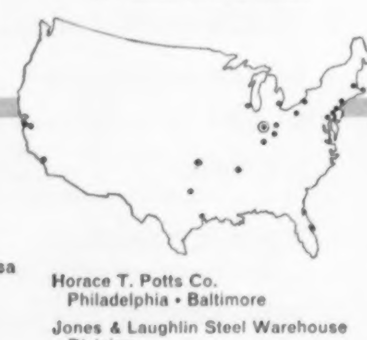

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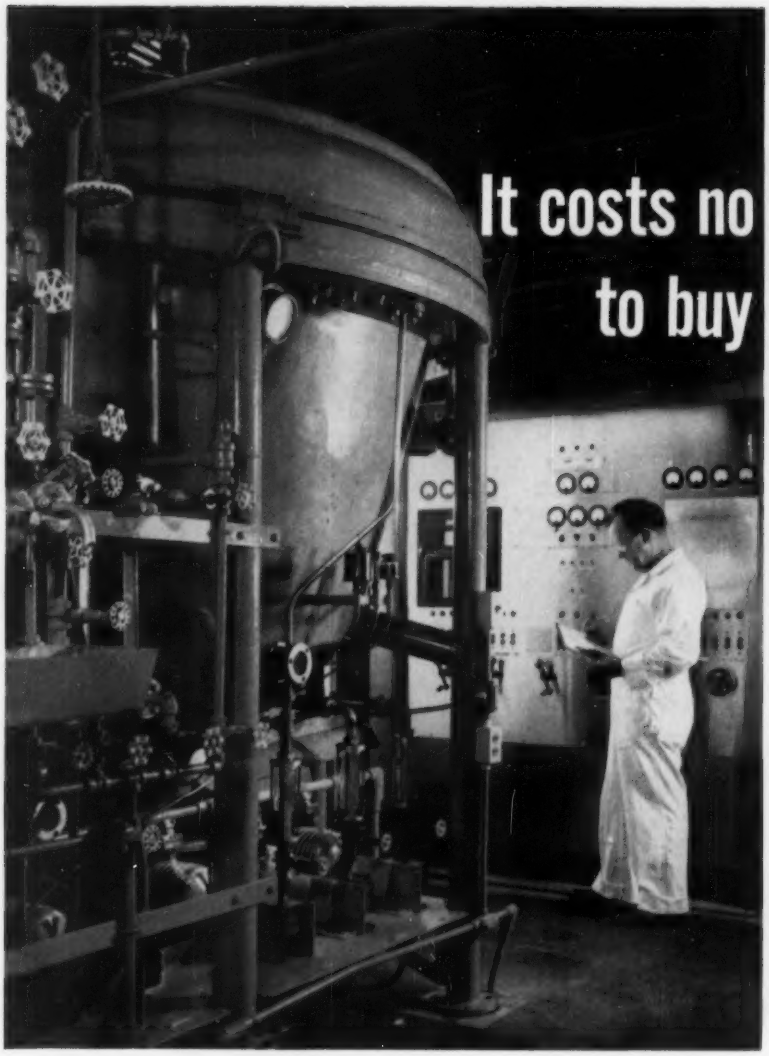

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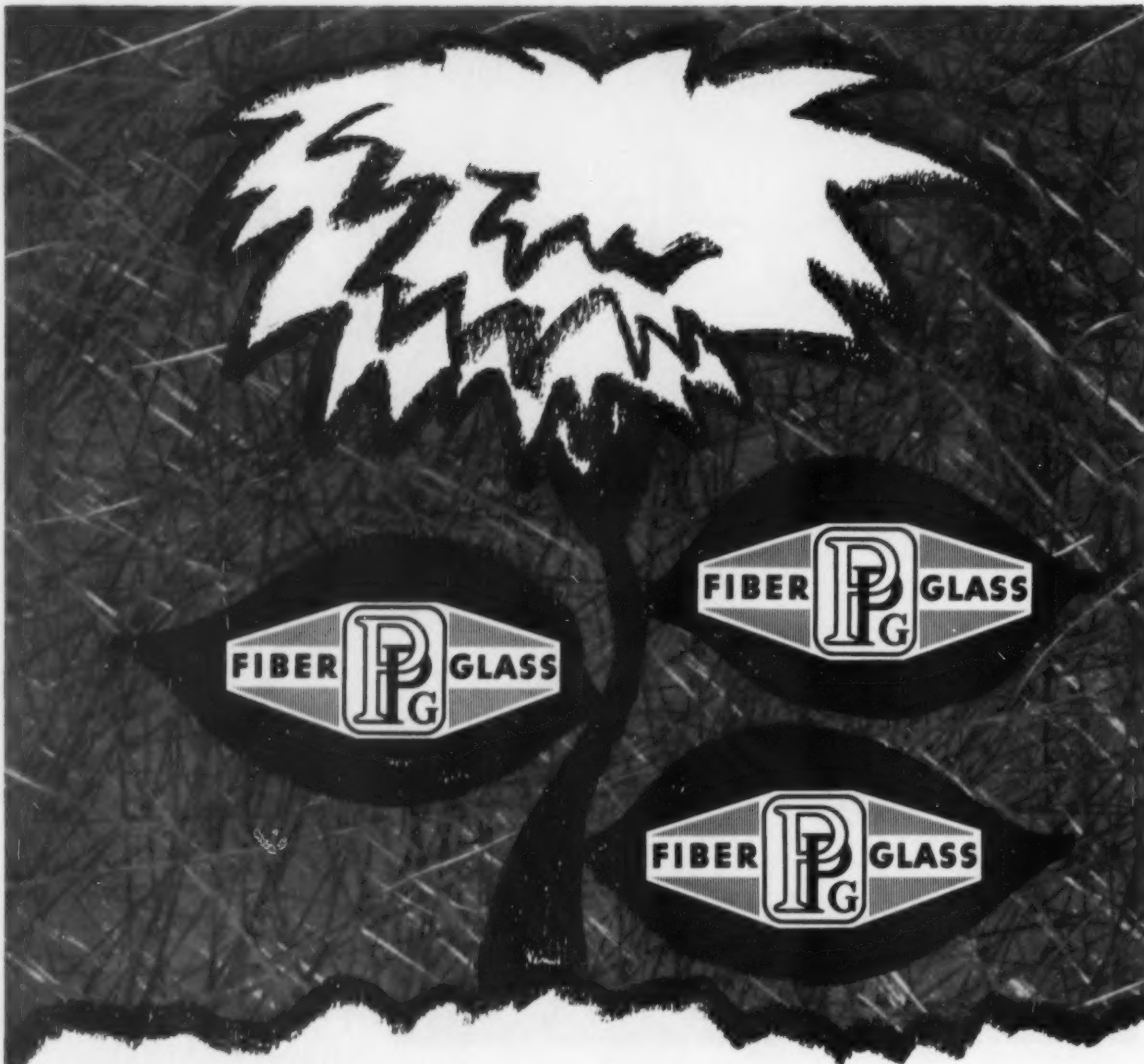

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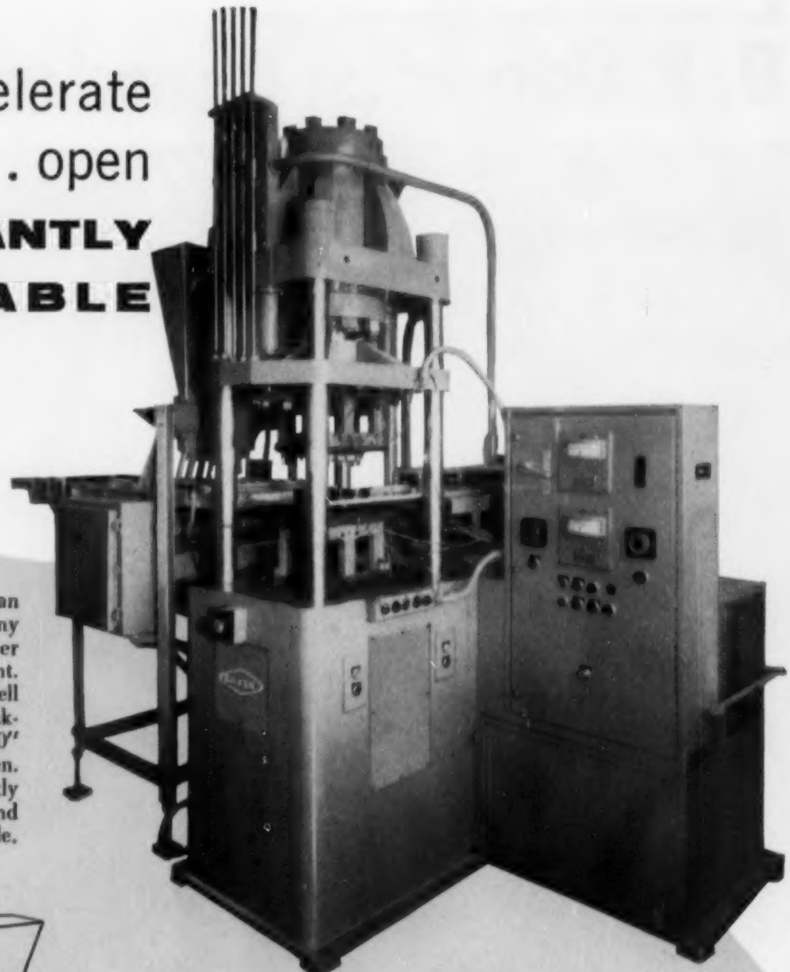

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MODERN PLASTICS
Volume 33
March 1956
Number 7

Automotive plastics: 1956

First of two articles on the ways in which motor car manufacturers are using increasing quantities of all types of plastics

The record-smashing 1955 statistics of the automotive industry carry tremendous import for the plastics industry. During that year, U.S. motor car manufacturers rolled out approximately 8 million autos, an increase of 40% over 1954. The total wholesale value of passenger cars shipped by manufacturers during 1955 is estimated at around $12 billion. And the auto-

Reinforced plastics cover for folding top of the Cadillac Eldorado is made in three sections, can be easily stored in trunk

Molded trim panels used on Ford's Country Squire station wagons are made of reinforced plastics with a wood grain finish

Latest model of Corvette, pioneer car with a plastics body, now also has removable glass-polyester top as optional equipment

Front and rear roof caps, front quarter panels, and windshield frame of International Harvester truck are reinforced plastics

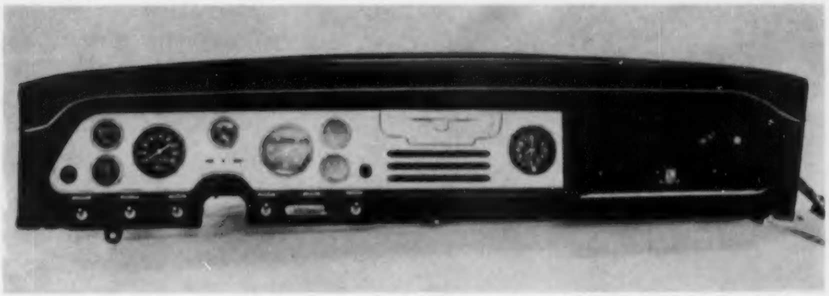
motive field, for years one of the most important users of plastics in all their varied forms, is rapidly increasing its consumption of plastics per car. It is estimated that the motor industry in 1955 used approximately 10 lb. of plastics per car, or about double the 1950 use.

Although top officials in the industry doubt that 1956 output will equal that of last year, important forces are in operation which tend to encourage high volume auto production. As pointed out by J. B. Wagstaff, DeSoto Div. vice president in charge of sales, the national income is at a new high, with over 65 million persons employed. "With the growth of suburbia," said Mr. Wagstaff, "and the increase of the multiple-car family (doubled since 1953 alone), and a replacement potential for the estimated 3 to 4 million cars that reportedly will be junked in the coming year, we foresee a 1956 market for new cars in the neighborhood of 7 million."

Any breakdown of the poundage of plastics

Rear fender fins on Studebaker's Golden Hawk are of reinforced plastics. Instrument panel is made of same material

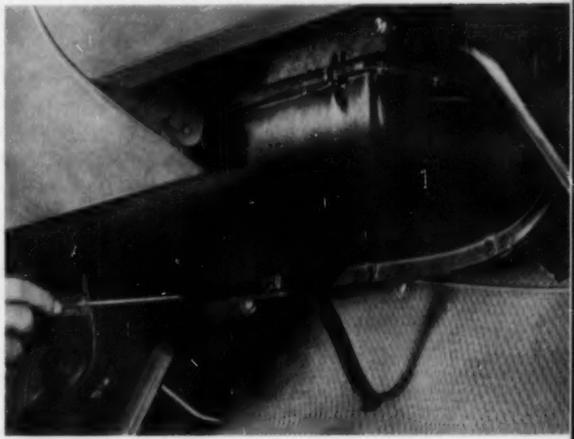
Close-up of reinforced plastics fender fin on 1956 Studebaker station wagon. Metal-plastic joint is concealed by stainless steel strip



One-piece reinforced plastics instrument panel used in Studebaker's Hawk line. The panel, sturdy and integrally colored, is produced with low-cost tooling

used per car is likely to be misleading because of wide variations between individual makes and models. Some estimates place total plastics usage by the auto industry during 1955 at more than 80 million lb., or the above-mentioned average of about 10 lb. per car. This is a reasonable figure, in view of statistics indicating that the average car now requires approximately 15 sq. yd. of vinyl or vinyl-coated materials, and that about nine-tenths of all the wiring used in automobiles is vinyl covered. This would indicate a total of 4 or 5 lb. of vinyl resins alone per car.

It should also be pointed out that poundage alone, although interesting, is not always a reliable measure of plastics progress in the automotive industry. Many of the newer materials—molded nylon, for example, as well as the formable sheet thermoplastic materials—are relatively light. Their function and utility in a given automotive application may be far more significant than the few ounces of weight involved.

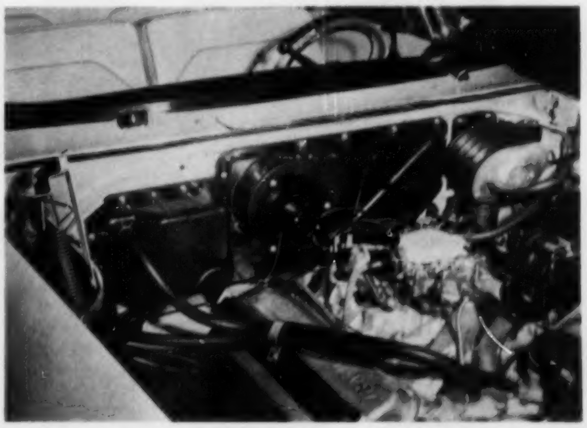


Housing of combination air conditioner and heater in Nash Rambler is molded of glass-reinforced polyester premix, requires no exterior finishing

Continuing increase expected

Whatever the figures reveal, however, there is every reason to expect a continuing increase. New applications are emerging which alone require approximately as much plastic material as the total amount used in the average car. One example of such a part is the formed sheet plastic roof liner being used in Plymouth station wagons. Reinforced plastics sports car bodies, now in regular production, consume 200 lb. or more of polyester resins per car, in addition to the fibrous glass reinforcement. New types of air conditioner and heater installations involve as much as 10 lb. of premix-type reinforced plastics per installation.

The "knob and button" applications of yes-



Two-piece heater housing of fibrous glass-reinforced polyester, used in many Chrysler automobiles, is economically produced by premix molding technique

Vinyl foam is used in arm rests of many cars. At left is metal base for one type of arm rest. (Photo, Elastomer Chemical Corp.)

terday are still here, because plastics have long since proved their suitability for these and many other small but vital automotive parts. But now the industry is moving into a new era, so far as the automotive field is concerned. Designers and engineers are thinking in terms of larger, heavier, and more fundamental plastics components. Material suppliers are ready with improved materials to meet every requirement from a tiny gear or bearing to complete body sections. Studebaker's pioneering program with reinforced plastics rear fender fins used in conjunction with a metal body may engender a completely new industry concept of how to soften the financial impact of periodic retooling.

The pattern is clear. The reinforced plastics "dream cars," around which admiring attendants cluster at every big auto show, indicate the trend of thinking by designers and engineers. They point the way to tomorrow's lighter, more agile cars, in which the whole broad family of plastics will be utilized to attain improved performance, greater passenger safety and comfort, and less costly repair and maintenance. Many of these trends are clearly evident in the 1956 cars, whose more important new plastics applications are reviewed in the following pages.

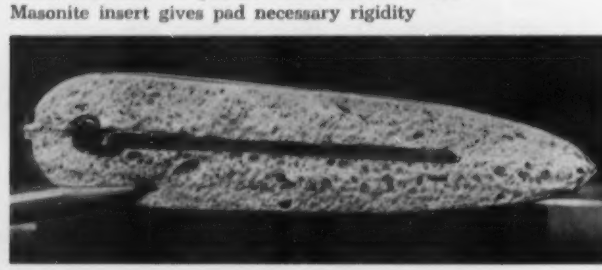
Reinforced plastics

Examination of the 1956 model passenger cars, sports cars, and trucks clearly indicates that reinforced plastics are moving rapidly into regular production components. This can mean important new volume and increased opportunities for companies having reinforced plastics production facilities.

Combinations of glass cloth, mat, or chopped rovings with polyester resin molded by con-

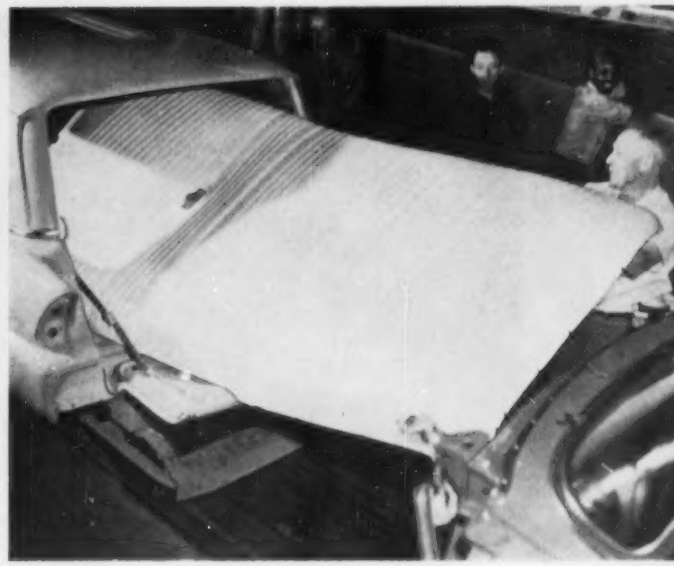
Cross-section of Ford instrument panel safety pad. Styrene copolymer sheet covers foam (PVC or urethane)

Urethane and vinyl foams, covered with vinyl skins, are used for padded visors in Ford cars. Masonite insert gives pad necessary rigidity



Instrument panel safety pad installed in Ford car is easily depressed by thumb. Resilience of pad is important safety factor

Scuff-resistant end panels for seats in Packard-Studebaker Clippers are formed of styrene-acrylonitrile-butadiene sheet



Roof liner, made of formed styrene copolymer sheet, is installed in Plymouth Suburban station wagon. (Photo, U.S. Rubber Co.)

ventional methods, as well as premixes involving polyester resins in combination with such reinforcing agents as chopped glass or sisal fibers, are involved in this important new trend. The latter materials, as pointed out later, are finding extensive use in parts for automotive heater and air conditioner installations, while the laminates are found primarily in body panels, dashboard assemblies, and even complete sports car bodies.

The Corvette

The Chevrolet Corvette, whose reinforced plastics body was the first of its type ever to be used in regular production by one of the major automotive manufacturers, made its appearance early in January with a completely restyled plastics body and even more outstanding performance. In appearance, the new Corvette can be quickly identified from its earlier counterparts by the rear quarters, which break from the horizontal follow-through that characterizes the popular passenger car trend. Rear fenders sweep downward, approximating in profile the curve of the luggage compartment. Simulated air scoops in the front fenders provide another new styling detail. In addition to the regular fabric top, power-operated, a new removable solid top, also molded of fibrous glass-polyester laminate, is now optionally available.

The Thunderbird

Ford's highly successful Thunderbird sports car, more than 16,000 of which were sold during 1955, is now available with a choice of two types of reinforced plastics "hardtops" in addition to the standard fabric top. The alternate hardtop, also of the lift-off, quickly installed type, features a port hole in each side for increased visibility. Both tops take advantage of the light weight, durability, and excellent weathering characteristics of fibrous glass-polyester laminates.

Plastics in fender fins

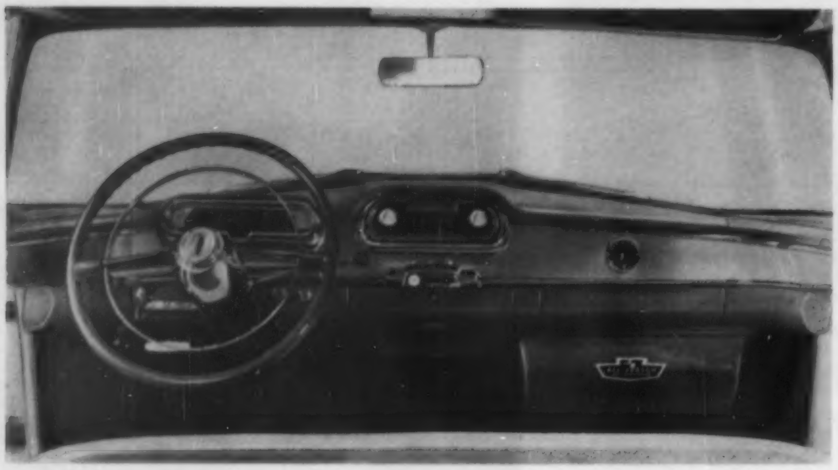
Some of the most significant new applications of reinforced plastics are found in the 1956 line of Studebaker passenger cars and Studebaker's new Hawk line of sports-type cars. These include a reinforced plastics instrument panel used on the Hawk series of four models, and rear fender fins which are used on the company's top-line station wagon, as well as on the smartly designed new Golden Hawk model.

The Studebaker fender fins probably mark the first instance in which a U.S. motor car manufacturer has utilized sizable reinforced

---

More to come

The accompanying article details the latest applications of reinforced plastics, plastics foams, and formed plastics sheet in the automotive industry. The other half of the story—nylon, vinyl, acrylic, Mylar, and butyrate in automobiles—will appear in our April issue.



Top of instrument panel in Hudson Hornet is covered with styrene copolymer crash pad. Reinforced plastics air conditioner housing at right is premix molded

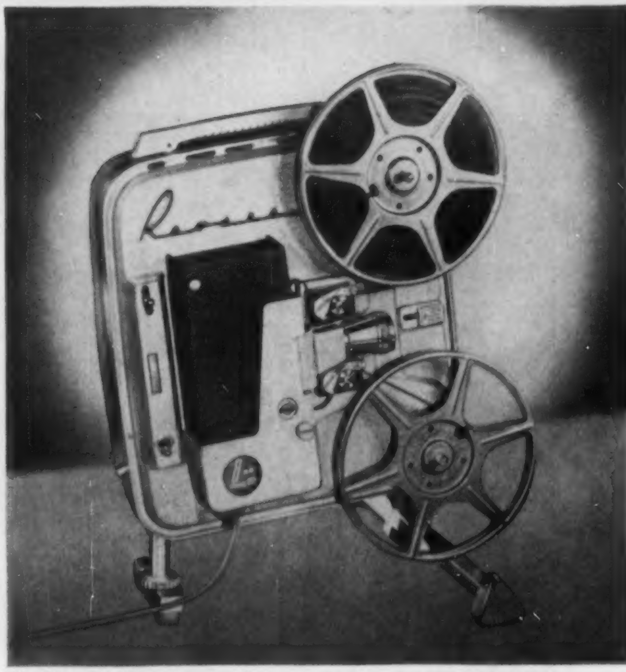
plastics components in combination with regular metal body panels to achieve distinctive styling changes without the necessity of additional expense involved in making special metal stamping dies.

By thus successfully blending metal and plastics body sections into a smoothly unified assembly, Studebaker has pointed the way to some interesting new concepts of automotive construction and styling. For example, manufacturers might well adopt this same approach to achieve variations on a basic body style without major additional tooling. The same technique has obvious application to interim styling changes which are customarily made between major retooling programs. Reinforced plastics body components lend themselves to rapid, low-cost production tooling, permit wide latitude of design treatment, and may be finished so that they blend perfectly in color with metal body sections.

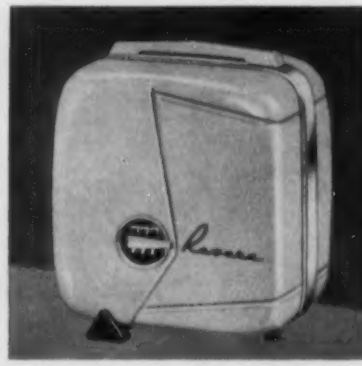
According to Studebaker, reinforced plastics were selected for these components "because of their relatively low volume and so that Studebaker technicians might properly evaluate the advantages of this relatively new material. To begin with," the company states, "the initial low tooling cost proved most attractive, permitting Styling to modify the station wagon and the Golden Hawk rear quarters without the heavy burden that would have been imposed should conventional methods of modification have been adhered to. As the first designs were put into clay, it was immediately apparent that certain shapes and contours formerly impossible to fabricate by stamping could be formed by this molding process. The assembly of the glass fiber items presents no major obstacle. When properly planned, so that joints are covered by moldings and ornaments, the assembly method is easily concealed. In general, it would appear that glass fiber holds promise of similar applications in the future."

The one-piece plastics fender fins, used on the new Golden Hawk and the Studebaker Pelham, Parkview, and Pinehurst station wagon models, are painted before being mounted on the cars. They are fastened to the fender by a series of studs bonded to the plastics fin, which extend through holes in the metal fender and are secured by nuts on the under side. The seam between the metal fender and the plastics fin is concealed by a strip of stainless steel, painted to match (*To page* 211)

Formed styrene copolymer sheet is used for pillar post covers on many four-door hard-top car models. (Photo, U.S. Rubber)



Motion picture projector, mounted permanently in one half of its lightweight plastic carrying case, ready to roll



Complete case, with projector inside; triangular projector leg tips fit into molded-in recesses

Case before assembly, showing formed parts (top) and latch knob, handle, and accessories

Revere sticks to plastics

With a background of plastics use in projector cases, camera company introduces new model with case halves formed of copolymer sheet

Formed copolymer sheet components, produced by a vacuum-assisted plug and ring technique, play an essential part in the case for the new Model 777 8-mm. movie projector, recently placed on the market by Revere Camera Co., Chicago, Ill. The attractively styled, highly functional case has been an important asset in the successful merchandising of this new projector, which retails at $127.50 yet matches in performance projectors costing considerably more.

In all, there are four formed plastic components used in the two halves of the new case. They include inner and outer mating parts which when cemented together comprise the removable cover or right-hand half of the case and two other components which, similarly assembled, constitute the left half of the case, in which the complete projector is permanently mounted. Both halves are reinforced around their outer edges by extruded and formed aluminum bands which provide increased rigidity and accurate fit.

Revere Camera Co. for some time has been using projector cases fabricated from various plastic materials. Several years ago, this organization introduced a lift-off style projector case formed in two halves of copolymer sheet

Formed copolymer sheet is removed from specially constructed press at end of cycle

Operator inspects formed piece produced by vacuum-assist plug-and-ring technique

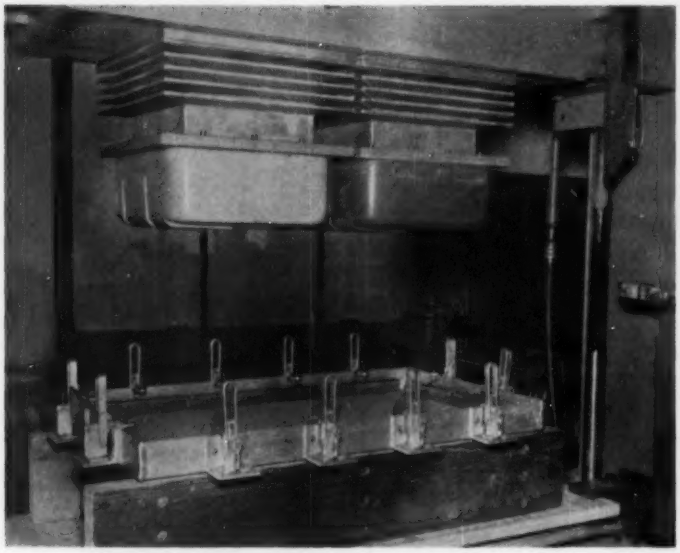
material, designed so that it latched to the metal base of the unit for convenient carrying by means of the handle at the top. Later, a similarly styled case was also adopted for certain model projectors; this case was compression molded from a wet felted preform containing glass fibers for added strength. Both types of cases continue to be used for various 8- and 16-mm. projectors.

Four parts of case

The design and production details of the new Model 777 case were worked out by Revere's engineers. The sheet stock used in the four case parts is a butadiene-acrylonitrile and styrene-acrylonitrile copolymer, which has exceptional strength, stain resistance, "built-in" color, and other desirable properties. The parts are produced in the Revere plant on presses built to the company's own specifications. After forming, trimming, and punching operations are completed, several interior components are mounted in the plastic sections and the metal extrusions are applied, readying the cases for final assembly.

The use of the formed sheet plastic material for the case of the new projector offers a number of advantages for both the manufacturer and the ultimate user of the equipment. With its glare-free grained finish, in a pleasing light gray color, the case is appealing to the eye without the need for any supplementary paint or other type of surface finish. Besides being highly scuff resistant, the resilient plastic sheet material provides excellent protection for the working parts of the projector and is virtually indestructible in normal use. Its light weight helps to make the entire assembly easy to carry, while the rounded contours obtained in the forming operation make the case easy to clean and eliminate needless bulk. Occasional wiping with a damp cloth will keep the case looking like new. Due to the resiliency of the plastic material, the cover may be flexed in-

Stiffeners, formed with reinforcing ribs, are cemented into case side of cover



Press in open position. Sheet is clamped in place on lower vacuum chamber; cast epoxy plugs are at top

Nested case cover and liner are trimmed to size on wooden fixture

ward slightly when the lock knob is turned, springing outward to produce a tight fit.

The material used in forming both exterior sections of the case is $\frac{3}{32}$ in. thick. Inner sections are formed from 0.080-in. material.

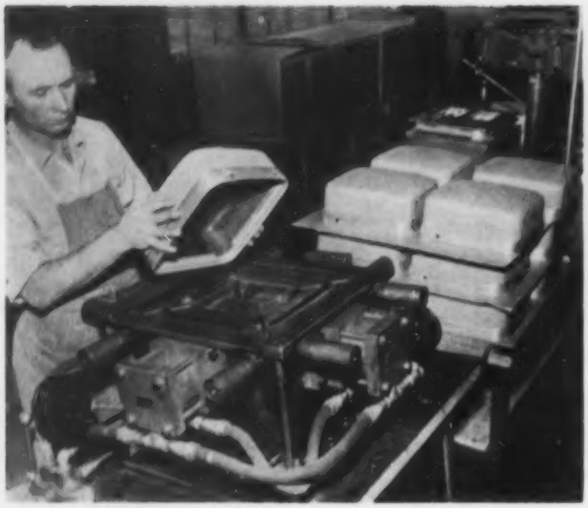
Two-cavity molds are used in forming each of the copolymer sheet parts. In general, the forming process involves positioning the preheated sheets over wooden bases divided to provide the two sections, drawing the material down into the cavities just ahead of the cast epoxy plugs, then reversing the vacuum and drawing the sheet back against the plugs as soon as the press has closed. In this modified version of the plug-and-ring technique, the heated sheet is shaped by being held in close contact with the male forms, which carry all details required in the finished parts.

Reinforcing aluminum bands are shaped on special machine; shaped bands are at left

Production details

Before starting the first run of the day, the plugs are heated by exposing them for a brief period to gas flames supplied by a portable perforated pipe arrangement. This insures more efficient forming and uniformity of wall thickness in the finished parts. Next, a sheet of calculated size and thickness for the overall dimensions of the piece is placed in a lightweight frame fabricated of magnesium sections and clamped around the edges by toggle-type fasteners with a serrated edge which firmly grips the material. The sheet, in its rigid supporting frame, is placed in an open-side-type of oven having a series of Calrod heating elements mounted in the top and controlled by means of an electrical percentage timer. The heating cycle varies from 45 to 80 sec. for the different pieces. In production, a single operator handles one press and oven simultaneously, keeping a sheet in the oven ready to be placed in the press as soon as each cycle is completed.

At the end of the heating period, the metal frame holding the softened sheet of material is immediately transferred to the press for the



Machine with expanding master die secures aluminum bands to case without rivets or adhesives

Band is drilled and tapped prior to mounting of steel base. (All photos, Revere Camera)

forming process. By means of a cam arrangement on the press controls, the plastic sheet is automatically drawn down into the lower section of the mold. Without further attention from the operator, the vacuum is then reversed, drawing the sheet back against the epoxy male plugs. At the end of the forming cycle, which ranges from 1 to 1½ min. for the different components, the operator trips a lever which opens the press. Another control directs air pressure against the inside surface of the newly formed parts to facilitate their removal from the plugs.

Side core in mold

The case component which mounts on the left side of the finished projector, has a rectangular depression at the bottom, approximately 3 by 7¾ in. in size, which is later blanked out to accommodate an air intake grille. This indentation is produced during the forming process by an air-actuated metal side core located in the lower section of the mold. Press controls are so interlocked that even if the operator neglects to trip the side core withdrawal lever, the core will withdraw automatically before the press opens, preventing possible damage to the plug.

The presses used by Revere for this forming operation, which are also employed in producing other parts from thermoplastic sheet material, have a number of interesting features. Simple and compact in design, they are constructed from steel sections, with the lower ram sliding on columns to insure accurate alignment. Each press, actuated by an air cylinder having a stroke of approximately 18 in., can handle parts as large as 50 by 24 inches.

Presses are engineered so that the operator has full control over the conditions which produce uniform parts with the desired wall thickness at all points. The special cam arrangement which admits vacuum to the lower chamber slightly preceding the entry of the plug, can be adjusted to suit the amount of heat in the blank and the amount of vacuum used. Once the position of the cam has been set, uniform distribution of thickness in the parts can be maintained.

In the Revere forming press installation, a single pump is used for different vacuum values, instead of separate pumps. This is accomplished through the use of a specially designed equalizing valve which insures admission of a constant preset value, regardless of unequal demands on the pump. The diaphragm of the valve opens or contracts to admit more or less pressure. Vacuum is obtained from a reserve tank, exhausted to approximately 26 in. of vacuum, which serves two presses.

Epoxy plugs desirable

According to Revere engineers, they have found cast epoxy resin plugs desirable for this type of vacuum forming because they can be readily fabricated in the plant, have a very low shrinkage value, and can be easily altered, if necessary, to meet minor de- (*To page* 221)

‘Voice boxes’ for talking toys

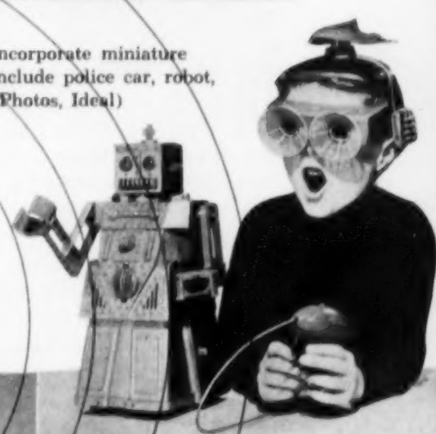
Long-wearing miniature vinyl records used in molded styrene phonograph device can deliver up to 25 sec. of recorded songs or messages

Although today's sophisticated youngsters seem to be taking it in their stride, the idea of toys that can talk distinctly for up to 25 sec. has certainly made Daddy and Mommy sit up and take notice. In the modern world of wonders, a doll that can recite all of “Rock-A-Bye Baby” makes the “Mama” doll of their time as old-fashioned as molasses candy—but then Daddy and Mommy didn't have the advantage of plastics to spark such wonders.

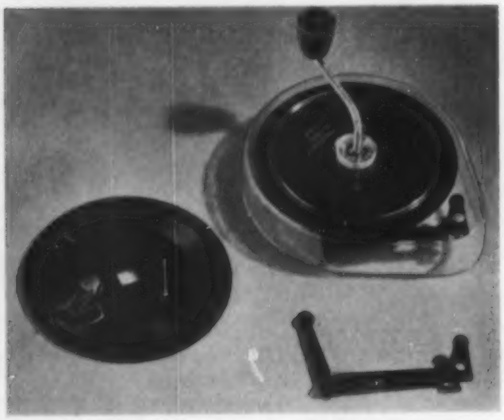
The voice that emanates from within these new mechanical and stuffed toys is produced by a revolutionary “talking” device based almost entirely on plastics materials.

This device is simply a miniature phonograph, housed in styrene, which is placed inside the body of the toys. A wire crank attached at one end to the internal mechanism of the device protrudes from the body. When the crank is turned, the miniature vinyl record within the housing revolves, the phonograph needle imbedded in the molded styrene tone arm contacts the grooves, and the recorded nursery rhyme, song, or other message is reproduced with re-

Talking toys that incorporate miniature plastics phonograph include police car, robot, doll, and telephone. (Photos, Ideal)



Records for crank-operated phonograph are pressed on standard disk. (Photo, Goodrich)



Die cut record is then placed in styrene case. Tone arm (foreground) is also styrene

markable clarity. Once the recording is finished, a spring-loaded lever automatically swings into action, pushing the tone arm back to its starting position for immediate replay.

So popular has the device proved that, although it dates back only to 1953, Ted Duncan, Inc., North Hollywood, Calif., originators and manufacturers of the "voice box," reports that it has already been placed in over 3½ million toy products—with current interest indicating an even greater market in the future.

Miniature vinyl records

The heart of the recording device and one of the most difficult of the parts to produce, is the miniature 3-in. diameter vinyl record. Because of the special requirements of the application, the miniatures are pressed under higher pressures for a longer curing cycle than standard records, and a special vinyl formulation had to be compounded for the job. The fact that the grooves (which are 0.010 in. wide) are 40% wider and deeper than those in standard records also necessitated a special stylus.

As the first step in the precision manufacture of the miniatures, a standard size 10-in. vinyl record is made from the special formulation. Five small records (up to six can fit on a disk) are then pressed on each of these disks and die cut in a single operation that simultaneously punches out the square center hole and the circular rivet hole which accommodates the reset mechanism. A special high-speed air-hydraulic press capable of turning out 19,000 records per day is used for this precision job. All scrap from the die cutting operation is mixed with virgin material and re-used.

The entire operation, from pressing to die cutting, is precision-controlled. As the production line is now set up, identical records can be grooved to an accuracy of ± 0.001 inch. The centering tolerances held during the high-speed production operation (2400 per hr.) are ± 0.005 inch. Actually, by holding these tolerances, the miniatures are more accurately centered than any commercial standard-size records now in use. The greater degree of accuracy is necessary because the small diameter magnifies any error. Ted Duncan is developing a method to hold centering tolerances to ± 0.002 inch.

During each phase in the production of the records, random samples are selected on a percentage basis and inspected under a high-power microscope for possible defects.

The finished vinyl records have a remarkably long playing life. Each is guaranteed for 1000 plays but independent laboratory tests have certified that the miniature records can go up to 6756 plays and still produce a voice that is loud and clearly understandable. Unofficial tests have gone as high as 13,200 plays. In addition, the special vinyl formulation is claimed to be such that the records acquire increased toughness and hardness on aging.

Final assembly line

The same degree of automation applied to the manufacture of the vinyl records is carried on throughout the other production and assembly steps. The company is currently geared to produce a minimum of 10,000 talking units a day, but capacity is estimated at a daily rate of 50,000 units.

To assemble the device, the reset mechanism is first riveted to the vinyl record. The record, in turn, is locked into place in the clear styrene

housing (molded in a four-cavity mold) by inserting the end of the wire crank through the square center hole and slipping a washer over it. Riveting is also used to fasten the molded styrene tone arm (molded in an eight-cavity mold) to the housing. Prior to this operation, the phonograph needle is hopper-fed into a molded-in opening in the tone arm.

As the final step, a flat cardboard diaphragm is glued over the open end of the housing. This is done mechanically by placing the diaphragm and housing in approximate position, applying a highly volatile cement, clamping the two parts together, and then automatically ejecting them after cure.

In the case of both the clear housing and the tone arm, the choice of high-impact styrene was dictated by the durability of the material and by the contribution it makes to clear, loud voice reproduction. Because of the high coefficient of fatigue memory and the extreme lightness of the styrene tone arm, for example, it can respond to frequencies up to 6300 cycles. This high fidelity of response to record groove signals helps to make the fricative, labial, and aspirate speech sounds more intelligible. Originally, the tone arm was to have been stamped out of cold rolled steel. The sound produced with the metal arm, however, proved to be inferior to that achieved with the plastic arm.

High-impact styrene in the housing is also claimed to provide better resonance and consequent louder sounds. In addition, its durability is an extremely important factor in view of the fact that the talking devices are used in toys subjected to considerable abuse by children. The styrene case is tough enough to withstand even the stresses set up by the riveting operation that is used to attach the tone arm to the housing.

Wide variety of toys

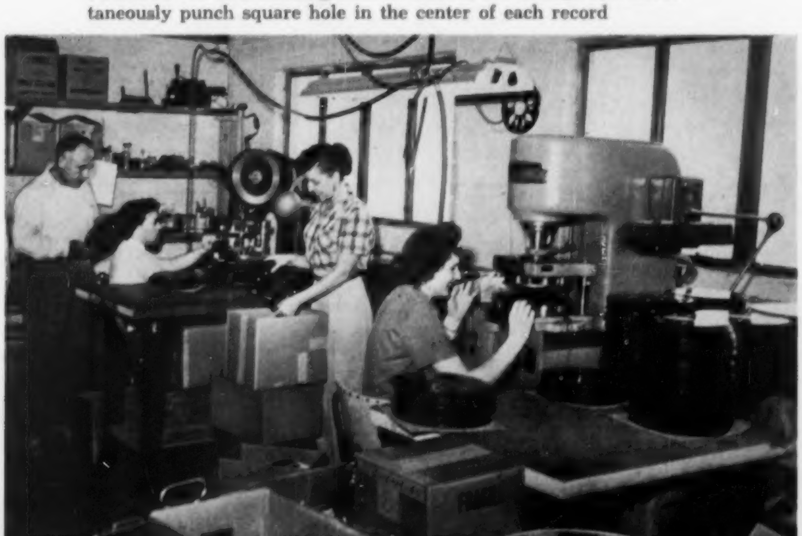
Perhaps the most extensive use of the talking device has been by Ideal Toy Corp., New York, N. Y., which buys the "voice boxes" as complete units and installs them in toys. Ideal's line of "talking toys" already includes an impressive variety, among which are: a telephone toy which asks, "Operator. Operator. Number please. What number are you calling? Thank you. I am ringing your number." . . . a toy police car that broadcasts "calling all cars" messages . . . a praying doll that goes through "Now I lay me down to sleep." . . . and a plush kitten that recites, "Pussy cat, pussy cat, where have you been?"

Several other such talking toys are already being marketed and more are on tap for the 1956 season in the categories of stuffed toys, pull toys, mechanical toys, dolls, and even wheeled goods.

To expand the market even further, Ted Duncan is currently working on a spring-operated phonograph device that will play instrumental music with high fidelity.

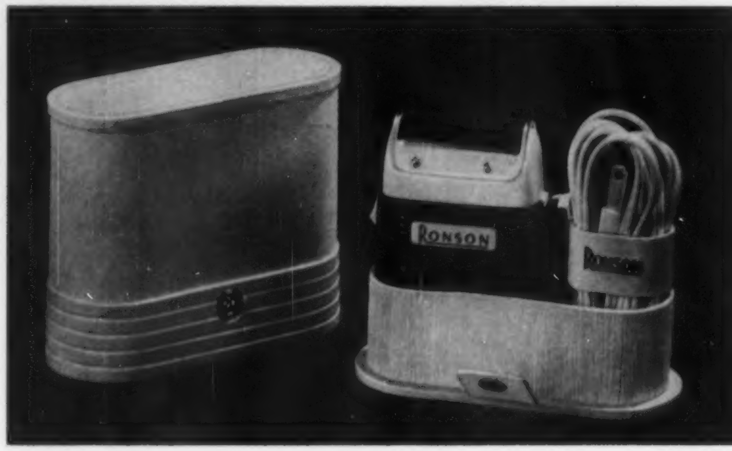
Credits: Geon vinyl for records supplied by B. F. Goodrich Chemical Co., and compounded for Ted Duncan, Inc., by Collins, Caldwell, and Dague, Paramount, Calif. High-impact styrene supplied by The Dow Chemical Co.

Presses for die-cutting smaller records out of large disk simultaneously punch square hole in the center of each record



Disks are inspected under high-power microscope. (Photos, Ted Duncan, Inc.)

Top of polyethylene carrying case for electric shaver (front view, left) telescopes over bottom half (below). Molded-in ribs in bottom half facilitate slip action



Luxury in a carrying case

Molded polyethylene gives new standard of quality appearance for merchandising Ronson electric shavers

In a dramatic departure from conventional design, Ronson Corp., Newark, N. J., has come up with a molded polyethylene carrying case for its electric shavers—the first all-plastics quality case of this type to be produced in large-volume quantities. Previous attempts by manufacturers of electric shavers to adapt plastics to the styling of a carrying case had centered largely on the rigid materials and along the lines already proved successful in low-cost cases for hand razors. But until the advent of Ronson's polyethylene unit, the all-plastics case was relegated to a minor role in the packaging of electric shavers—well below that of all-leather or leather-covered cardboard and metal cases.

Ronson now feels that the situation is in for a radical change. As evidenced by the enthusiastic reception by dealers and consumers alike, polyethylene is a "natural" for the application . . . so much so that Ronson is currently turning the cases out at the ratio of three polyethylene cases to every all-leather one. The annual production run on the job is already well in the hundreds of thousands. And as Ronson, a relative newcomer to the electric shaver field, expands its market, a proportional rise in production can be expected.

Utility plus beauty

Predominant among the many reasons for selecting polyethylene for the application are the outstanding impact- and shock-resistant qualities of the material. The case will withstand the abuse normally accorded a carrying case for bathroom accessories without breaking, denting, or warping. Even if accidentally dropped on a hard bathroom tile floor—a fairly common occurrence—the flexible case resists damage, and, by absorbing shock, helps to protect the delicate shaver parts from injury.

In addition, polyethylene is inert to virtually all the materials with which it might possibly come in contact in bathroom use, and it can

be cleaned simply by wiping with a damp cloth. The resiliency of polyethylene and its pleasant feel to the touch have also contributed to the success of the application. From the standpoint of eye-appeal, the rich ivory coloring of the polyethylene case, set off by the trademark in contrasting black, has proved especially attractive to consumers as well as to display-conscious dealers.

Yet, with all these advantages, the polyethylene-packaged shaver, at $19.95, is priced $2.55 less than the shaver in an all-leather carrying case. To a large extent, the economies inherent in molding the case, complete with integral hinged tab, in two simple pieces make the low price possible. According to Ronson engineers, the entire case was conceived, designed, tooled, produced, delivered, and put in the channels of trade in less than seven weeks.

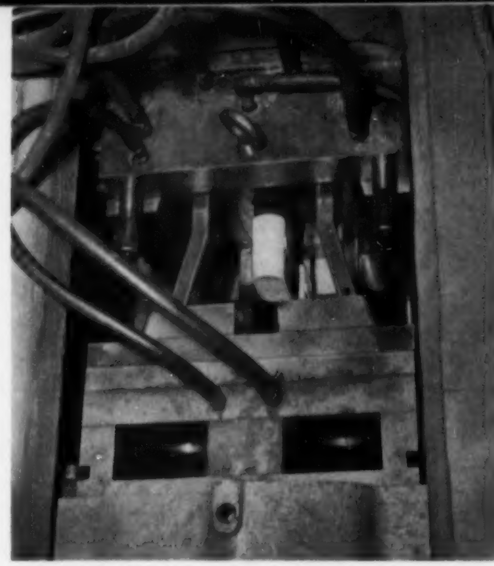
Molding procedure

The upper half of the polyethylene case telescopes over the shallow bottom half and is held in place with a snap fastener attached to the molded-in tab. Both the upper and lower halves are molded in two-cavity molds in an 8-oz. Lester-Phoenix machine.

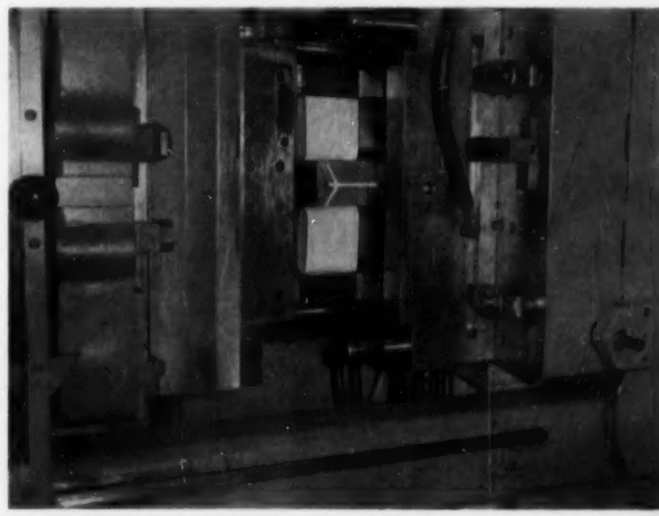
To lend the necessary degree of rigidity to the unit, the wall sections of the two molded parts average about 0.080 in. thick. Around the bottom lip of the top half of the case, however, five molded-in parallel bands increase the wall thickness to about 0.125 inch. The function of the bands is twofold—they serve both as a decorative element and as a means of reinforcing the lip so that it does not collapse or bend when forced against the base of the unit in closing.

The bottom half of the case also incorporates several molded-in features. A supporting wall, for example, molded between the two sides of the bottom half, separates it into two convenient compartments—one for storing the shaver and the other to accommodate the electric cord and the cleaning brush. A flat strip of flexible polyethylene, which is nothing more than a continuation of the bottom edge of the base, serves as the integral hinged tab. Holes for the two parts of the snap fastener—the socket part is located in the tab, the ball part in the top of the case—are also molded in.

Of special interest in the design of the bottom half of the case are the series of very fine vertical ribs molded around its entire outside surface which comes in contact with the top half. These ribs facilitate opening and closing. Since the top half of the case (*To page* 225)



Sky view of two-cavity mold for top of case

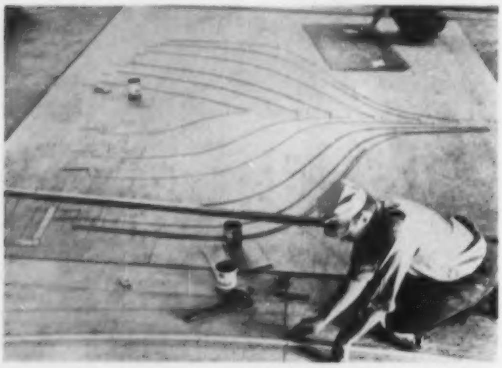


Front view of mold with parts still on plugs

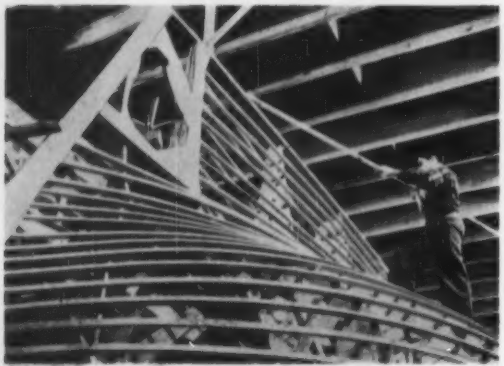
Operator removes parts. (Photos, Auburn)

Big boat — no mold

Hull of ocean-going vessel is built up of layers of resin-glass and veneer over inexpensive wooden frame



First step in construction of boat is lofting of templets to establish shape of hull



Horizontal battens of light lumber, nailed to vertical forms, establish contours of hull

A new method used to build a 16-ton, 42-ft. sailboat out of fibrous glass-reinforced polyesters eliminates high-cost molds and makes it possible and practical—for the first time—to custom-build such boats at a cost only slightly, if at all, more than conventional wooden hulls.

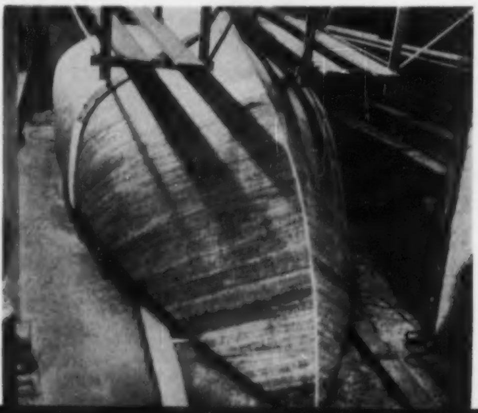
The method of manufacture was the joint creation of Jean Henri Filloux, a French engineer and explorer who will pilot the boat on a scientific expedition to the South Seas, George Hofmann, well known American naval architect, and Sparkman Stevens. The boat, named "Arpege," is an auxiliary ketch and its construction was sponsored by Luria-Cournand Inc., Havre de Grace, Md., reinforced plastic molders, with strong assists from 26 other corporations, in the interest of increased technical and scientific knowledge.

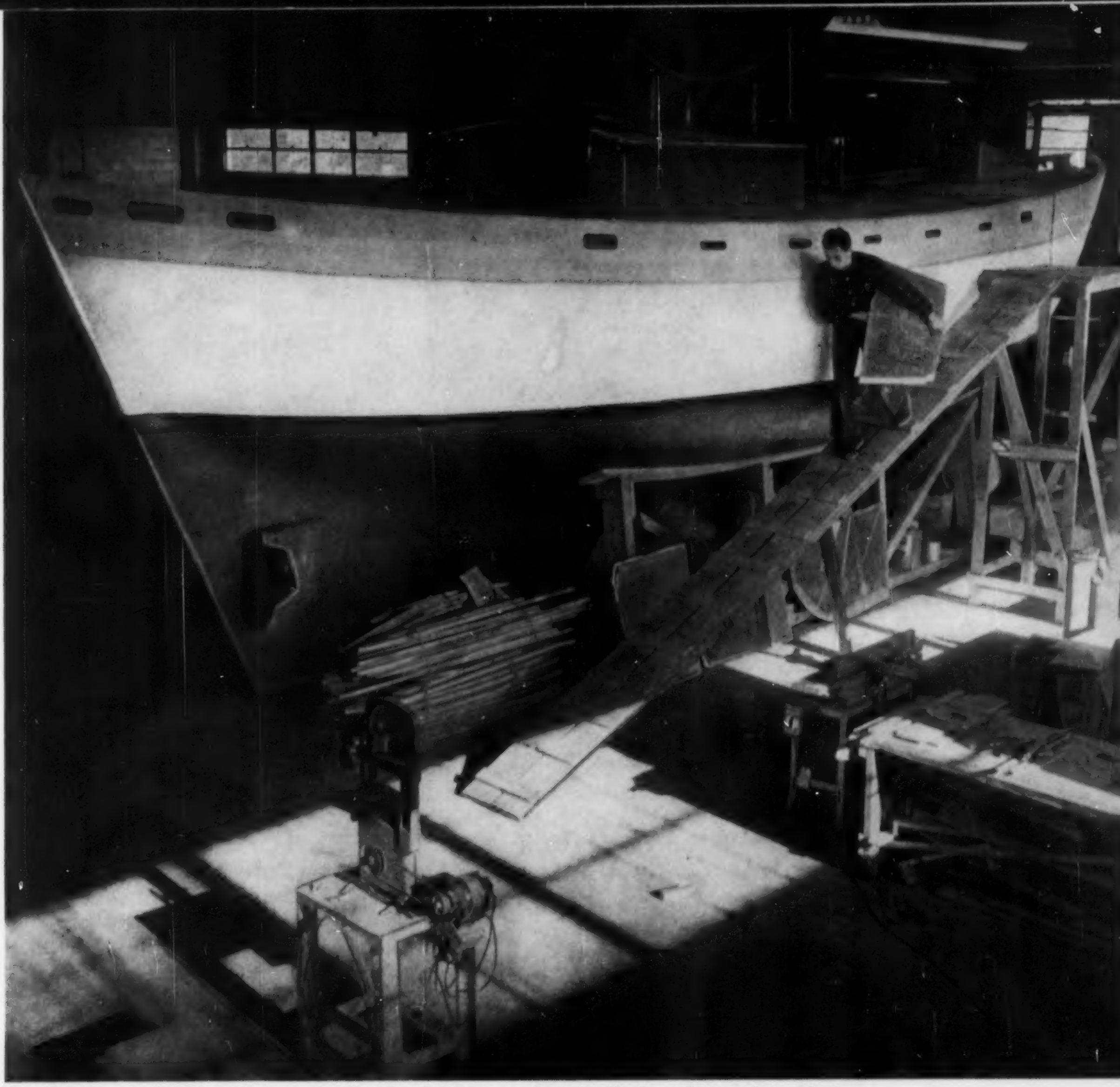
Ocean-going vessels of this size are almost invariably custom-built to special designs and seldom, even in fishing fleets, are many made of any one design. But the cost of constructing a huge mold of plaster, metal, or even reinforced plastics itself, would be prohibitive. The designers used in place of a mold a "composite hull"—a thin shell of mahogany veneer shaped over a conventional hull form. The four-ply veneer shell is molded-in as a permanent inner hull. Total tool cost was less than $500.

First step was the lofting of templets for conventional boat stations. When the forms were set in place, keel up, light battens of cheap

Stretched vinyl film is attached to vertical battens, then layer of mahogany veneer is stapled to them

Finished interior hull, ready for outer layer of glass cloth and polyester



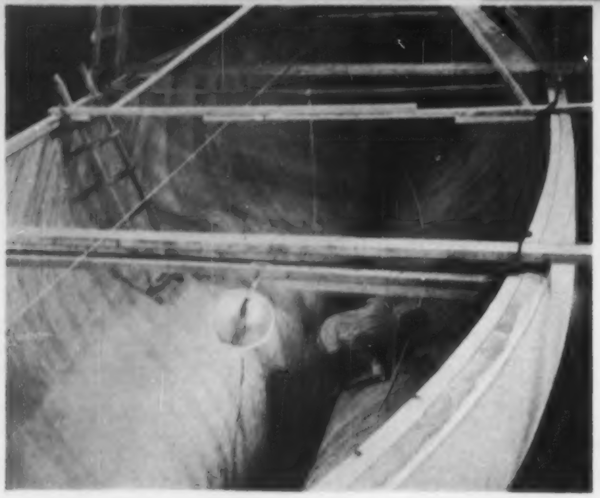


The Arpege, hull and deck finished with Monel fittings, ready to be fitted out for sea duty. The boat weighs about 2 tons less than wooden vessels of equivalent size. (All photos, Owens-Corning)

First of many glass cloth layers is laid up on last layer of veneer

Completed hull, cured, ready for finishing operations

Surfaced with pigmented polyester, hull is ready for turning



Turned keel down and with battens and frame removed, hull is ready for fitting of bulkheads and deck

Deck frame is fastened in position on hull with Monel screws and epoxy-glass tape

lumber were nailed to them horizontally to create the contours of the hull over this frame of battens. Sheets of polyvinyl chloride film were stretched and stapled in place to prevent the following application of veneer laminate from adhering to the forms and stringers.

A layer of low-cost mahogany veneer was then stapled in strips ⅛ in. thick and 4 in. wide (for easy handling) over the vinyl film, the fastening being done with Monel metal staples. Over this first veneer layer was applied a layer of 11-oz. fibrous glass cloth, saturated with resorcinol cold-cure adhesives. Then successive layers of veneer and glass cloth were applied in the same manner with two final layers of veneer for extra strength. Over the final veneer layer went as many as 16 layers of glass cloth, brush- or roller-coated with polyester resin catalyzed for air cure.

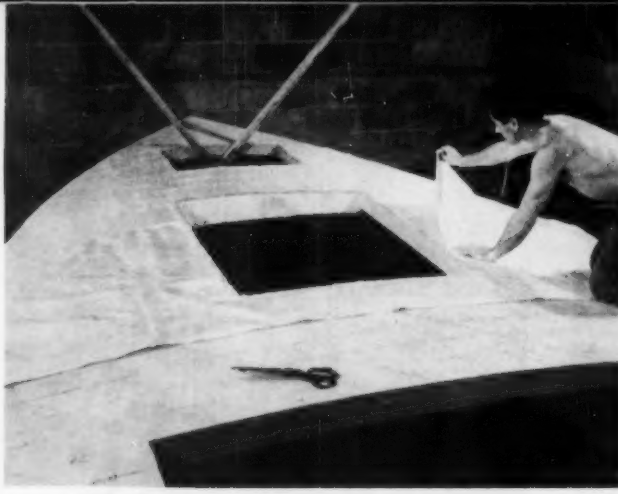
Once the hull was completed and cured, it was turned over with slings and the stations, battens, and vinyl film removed from the inside. The bulkheads, manufactured by Luria-Cournand from paper-phenolic honeycomb and edge-reinforced with fibrous glass and polyester resin, were fastened into place with Monel fastenings and sealed with glass tape and epoxy adhesive.

The cabin floor, sides, top, and deck, made

Frames for bulkheads are attached to hull interior by means of epoxy adhesive

Bulkheads are made of phenolic-paper core, glass-polyester skins

Adhesive and glass tape are applied to secure bulkhead



Glass cloth, cut to size, is laid up on deck, preparatory to impregnation with polyester resin

Polyester resin, catalyzed for air cure, is applied to glass cloth on deck with rollers

of wood, were fastened with Monel screws and covered with glass cloth and polyester. The ballast was metal-reinforced concrete, poured in place; and the masts were stepped in the ballast, which also provided a base for mounting the engine, generator, and other equipment.

Altogether 3000 yd. of cloth 44 in. wide was used and over 4500 lb. of polyester resin.

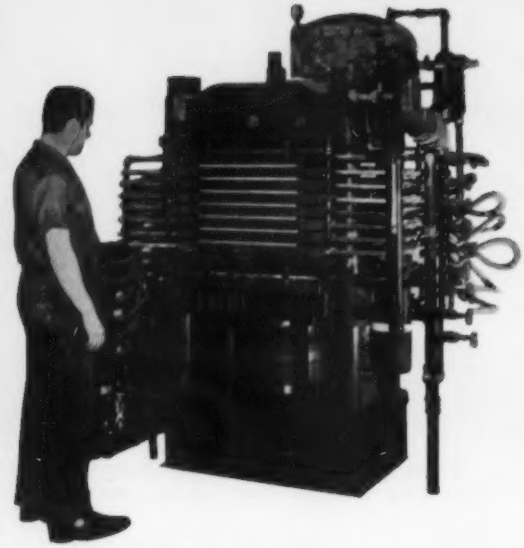
The boat weighs approximately 4000 lb. less than a wooden boat of the same size, is corrosion- and decayproof, is easy to debarnacle, is impervious to marine borers, will need practically no maintenance, and, with less frictional resistance, must be faster than a similar-size boat made out of any other materials.

The unique tooling operation is the key to future production and marketing of big seagoing reinforced plastics boats, because every boat building shop has standard facilities for doing the same kind of job.

Credits: Construction—Luria-Cournand, Inc., Havre de Grace, Md.; Laminac polyester resins—American Cyanamid Co., New York; Fiberglas—Owens-Corning Fiberglas Corp., New York; Fiberglas fabric—Hess, Goldsmith & Co., Inc., New York; Cascophen resorcinol glue—The Borden Co., Chem Div., New York; Mahogany veneer—The Williamson Veneer Co., Cokeysville, Md.

Metal-reinforced concrete, troweled into keel, serves as ballast and base for equipment

Completed hull of sailing craft, ready to be transported to the fitting-out yard



Laminating and press-polishing of printed vinyl sheet is accomplished on multi-platen press. (Photo, Allegheny Plastics, Inc.)

Vinyl sheet stock for calculators is imprinted with vinyl inks, then goes through drying chamber. (Photo, Graphic Calculator)

Precision fabrication makes versatile calculators

Sheet plastics can be accurately printed and formed to produce a wide variety of wear-resistant figuring devices which will not warp or distort

By compressing mountains of data into conveniently accessible form, ingeniously designed calculators, selectors, demonstrators, and related devices fabricated wholly or partially of plastics have won an important place for themselves in modern business and industrial life. These calculators are usually designed with either sliding or rotating scales so arranged that engineering data, price information, or other facts may be quickly and accurately correlated . . . without necessity for time-consuming repetitious figuring, re-figuring, and checking.

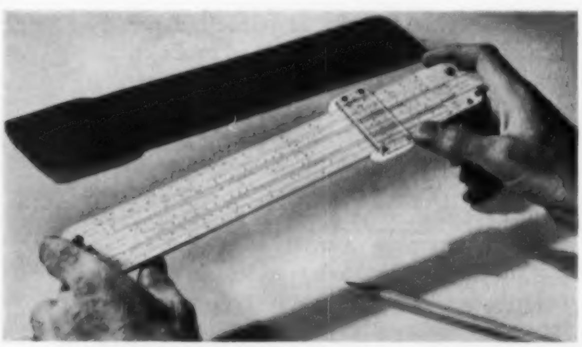
The type and amount of information which can thus be condensed appear to be limited only by the ingenuity of the designers. A growing number of manufacturers are already using the computing devices to disseminate useful information on their products to customers; more and more engineers are finding them handy for on-the-spot computation of specialized technical problems; and, even for the layman, calculators and selectors are available from trade associations and similar groups that offer such widely varying data as the nutritional value of various foods (for dieters) and the exchange values of the more common currencies (for those planning to go abroad).

In addition to their extensive use in the special-purpose type of selector and calculator

described above, plastics are also widely utilized in the production of stock calculators, slide rules, pricing guides, etc., which may either be sold directly to users or imprinted with the names of manufacturers or distributors and used as promotion pieces.

Advantages of plastic

Since the value of these calculators and sales stimulators depends primarily upon the permanent legibility of their printed content, a material which readily accepts printing by various methods, such as plastics, must be used. Plastics also provide either complete transparency —a basic requirement for many types of calculators—or a wide choice of colors and surface finishes. By working with transparent sheet materials, fabricators may leave any desired areas (e.g., slots, windows, etc.) unprinted so that printed data on movable slides or dials beneath the sheet can be read clearly, while protected against dirt or abrasion.



Durable slide rule, fabricated of rigid vinyl, is light in weight, will not warp or jam regardless of climatic conditions. (Photo, Bakelite)

The dimensional stability and toughness of selected sheet plastics also help to explain why these materials have become generally adopted for this type of work. In addition, they are easily wiped clean, will not pick up any grease or oil with which they may come in contact, and are not adversely affected by most commonly encountered solvents and other chemicals.

Vinyl copolymer sheet

While the use of sheet plastics for devices of this type is not new, there has been a recent upsurge of interest in many quarters. For many years, cellulose nitrate was widely used, since it provided transparency, excellent printability, and outstanding toughness. In more recent years, however, this material has been largely supplanted by other plastics which have improved dimensional stability and are free from certain fabricating and end-use limitations.

At the present time, rigid vinyl copolymer sheet is by far the most widely used material in this field. Acrylic, in the form of sheet stock or molded components, also finds its way into a number of high-precision calculators, slide rules, etc., while cellulose acetate sheets are frequently used in fabricating relatively simple rulers and a variety of advertising specialty items.

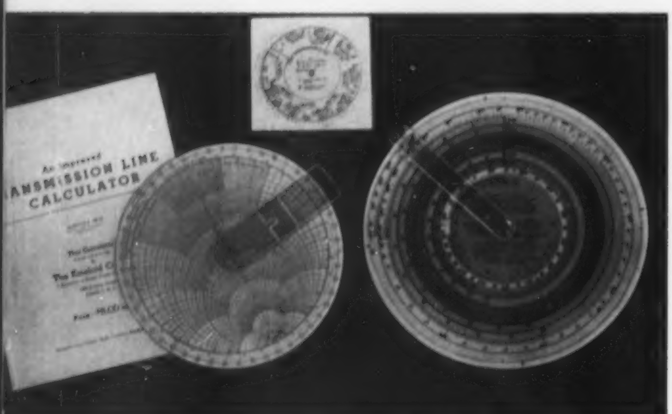
Slide rules, calculators, and similar devices

Sales aid slide rule computes cost and weight per sheet of modified styrene—of which it is made. (Photo, Chicago Molded Products Co.)

Currency converter of dial type is printed in two colors to facilitate use, fits in pocket or wallet. (Photo, Bakelite)

Window-type cover of booklet (top) aids in aphasia diagnosis; dial-type unit below helps in choosing records. (Photo, Graphic Calculator)

fabricated from the rigid vinyl copolymers resist moisture and warpage, have excellent dimensional stability, and provide calibrations that are sharp and accurate; they are durable, flexible, and light in weight; and they successfully withstand contact with most chemicals, oil, grease, water, humidity changes, and temperatures up to 130° F. Available in clear transparent and colored translucent or opaque, these sheets may be press-polished or matte-finished on both sides, or press-polished on one side and matte-finished on the other. Matte finishes are frequently employed when pencil markings are to be made directly on the calculator and later erased. This feature is used to excellent advantage in a Switch Visualizer made by Graphic Calculator Co., Chicago, Ill., for Centralab Div., Globe-Union Co. This device is used by engineers to set up and study experimental switch combinations. Blueprints can be made directly from the Visualizer and pencil changes made on the matte surface and erased as often as desired.



Transmission line characteristics, fertility cycles, weather data can be calculated with circular vinyl slide rules. (Photo, Emeloid)

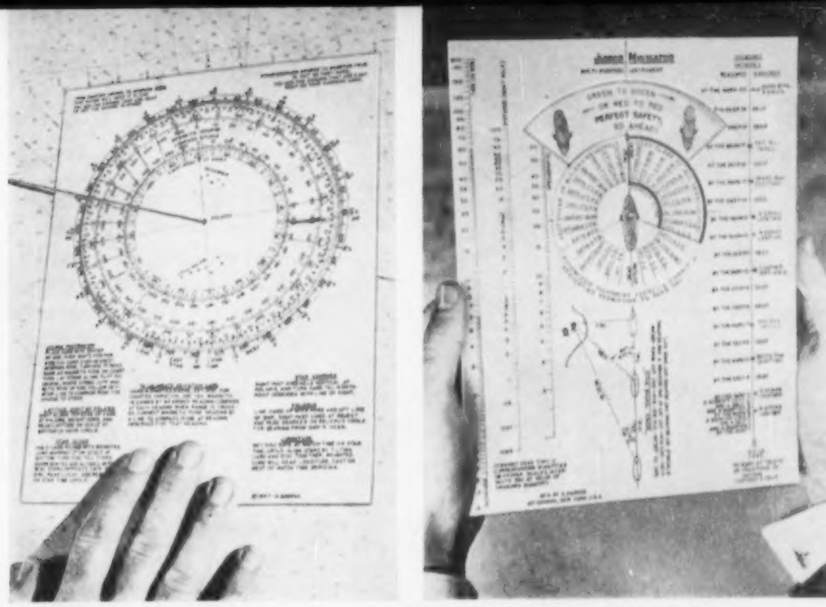
Another currency converter, this one in the form of a booklet of spirally bound press-polished vinyl. (Photo, Emeloid)

Design and printing problems

Except for relatively standardized devices such as slide rules, percentage of profit charts, etc., every calculator, selector, or demonstrator intended to cover a particular set of variables involves an individual design problem aimed at accommodating the data to be presented in the most attractive and convenient form. The size of the device, number of colors in which it is to be printed, number of scales or dials involved, and the conditions under which it will customarily be used are among the points which must be considered in working out the final design.

Study of the data to be processed enables the designer to determine whether it can best be handled by means of logarithmic or direct reading scales. A decision must also be made between rectangular and round types. One advantage of the round design is its compactness. An 8-in. diameter slide rule, for example, can accommodate a scale which would require a straight-type calculator more than 20 in. long. The round style also affords more area for printing illustrations, informational copy, and advertising material, and eliminates any chance of the user running the pointer off the scale.

Zinc plates are widely used in letterpress printing of scales on plastic sheet stock, while copper plates are generally employed for half tone work. Rubber plates are frequently used for printing solid backgrounds; the silk screen



Piloting device of rigid vinyl for small-boat navigation includes on its two sides practically all necessary data for off-shore boating. Three-color printing on this calculator is protected by a vinyl overlay. (Photo, Bakelite)

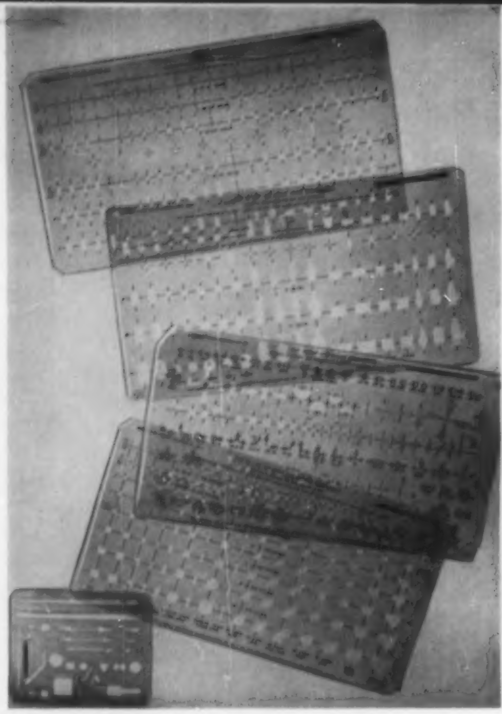
process is also utilized for this purpose, particularly for low-cost advertising specialties fabricated from plastic sheet stock. Most calculators and similar devices are printed in one to four colors, although some jobs may involve six-color process printing. In general, letterpress or offset printing (lithography) are favored for volume work or projects involving fine gradations.

Printing is customarily handled on conventional flat-bed presses. The size of the sheets used depends upon the printed area required, length of the run, and related factors. In printing on rigid vinyl sheet stock, vinyl resin inks may be used which "bite" into the plastic surface and may be set with a high gloss by means of a subsequent press-polishing operation. This process also imparts a higher finish to the plastic sheet itself.

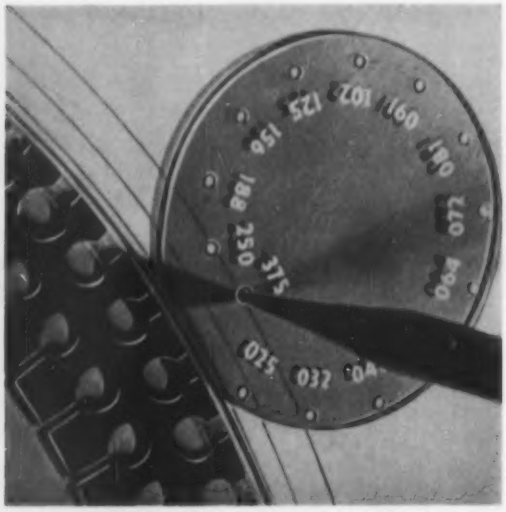
Drying may be expedited in some instances by racking or slip-sheeting the printed plastic

Workers' efficiency is increased through use of production control charts made of vinyl. (Photos, Bakelite)

Thermostatic bimetal calculator consists of five vinyl slides, one acrylic cursor. (Photo, Graphic Calculator)



Reversible vinyl templets are used for drawing general layouts or details of piping systems. (Photo, A. Lawrence Karp)



Rigid vinyl sheet, 0.025 in. thick, is used to make precision templets for drafting work. (Photo, E. F. Twomey Co., Inc.)

sheets. In other instances, provision is made for the freshly printed sheets to pass a source of moderate heat, such as infra-red lamps.

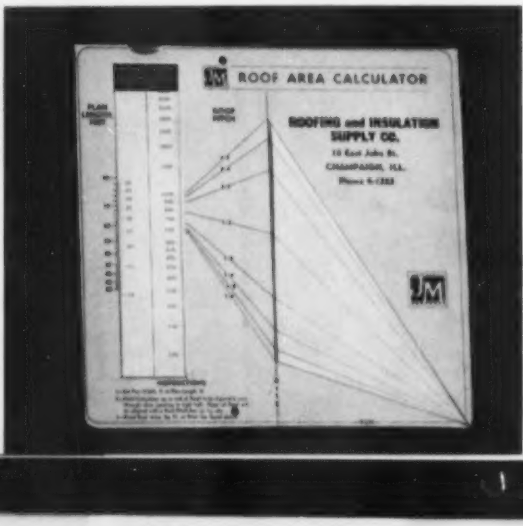
Many calculators, selectors, etc., are so designed that different sets of data are presented on each side of the device. In such cases, all movable scales must be indexed, front and back, with a high degree of accuracy. This calls for very precise work in printing and subsequent die cutting.

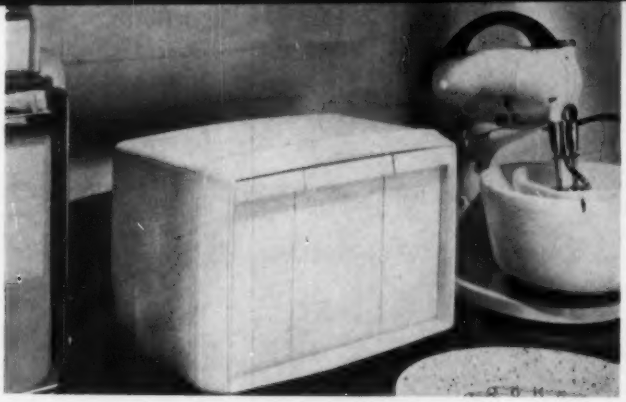
Finishing operations

If the printed plastic sheets are to be laminated or press-polished, these operations are performed before die cutting and prior to final assembly. Press-polishing is performed by subjecting the sheets to controlled heating, pressure, and cooling in a multi-platen type of press; equipment of the same type is used when transparent overlay sheets are to be laminated to the printed stock. One major supplier—Graphic Calculator Co., Chicago, Ill.—makes use of a "cold laminating" process, which is said to preserve high accuracy of the printed scales. In most instances, laminating is used on military-type computers or others requiring a particularly high degree of durability and printing protection. Press-polishing is usually sufficient for most commercial- and advertising-type calculators and similar devices. If printing is done on the underside of clear transparent stock, no subsequent laminating or press-polishing is required.

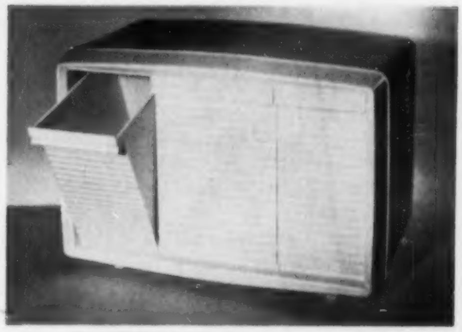
Die cutting of the individual parts from the printed sheets is performed by means of steel-rule or male-female blanking dies. In instruments of the slide rule type (as well as some dial types) requiring a sleeve or case, the case is formed by heating and bending the plastic material. The overlapping portion is tucked under the folded margin, forming a sturdy case for the movable scales. In cal- (*To page* 228)

Transparent portion of roof area calculator permits viewing of actual roof to determine pitch. (Photo, J. B. Carroll Co.)

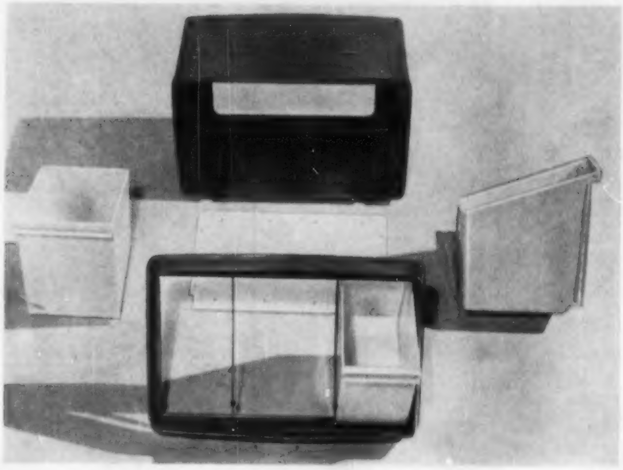




Bin cabinet, fabricated of molded high-impact styrene, fits in perfectly with today's high-styled kitchen



Tilting action of bins is made possible by sharp angles molded into lower leading edges of bins. (Photos, Henry Keck)



Components include cabinet, bins (side and front views), facia (with one bin in place); back-up plate

Food bins in styrene

Inherent design potential and high strength characteristics of impact material are fully utilized in the development of a top-grade kitchenware item

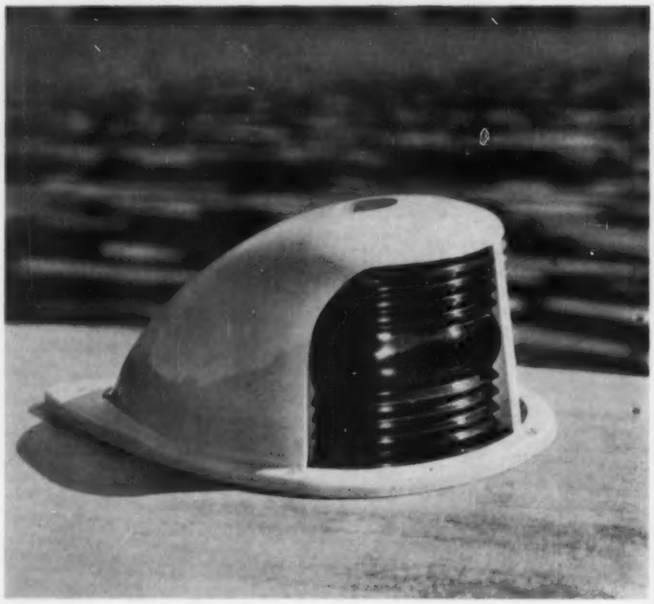
The mushrooming trend toward up-graded plastics housewares is given added impetus with the introduction of Bin-Ette, a table top bin cabinet of high-impact styrene which combines handsome styling with high utility. Intended for the storage of kitchen staples and designed to replace conventional canister sets, the Bin-Ette has the clean lines and the color range characteristic of modern kitchen decor.

The unit is made up of six parts: three tilting bins, a cabinet, a frame (facia) that attaches to the front of the cabinet and serves as a finishing border and at the same time provides pivot support to the tilting bins, and a pestproof back plate. The cabinet measures 14¼ in. wide, 9 in. high, and 8 in. deep. The large center bin has a capacity of 261 cu. in.; the two smaller end bins have a capacity of 126.75 cu. in. each.

Molding and assembly

With the exception of the back plate (made of paper board dip-treated with clear styrene and toluene), all components are molded of high-impact styrene on a 26-oz. injection machine using four individual molds. Supporting "legs" are molded into the cabinet and the facia. The bins, with molded-in grooves on the front surfaces, add a striking decorative touch to the finished assembly; sharp angles molded into their lower edges permit (*To page 240*)

Streamlined housing for boat light



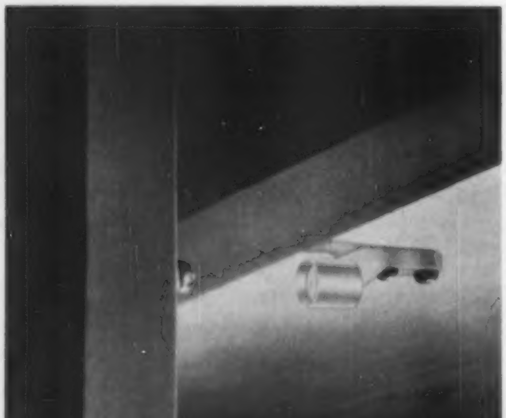
Designed for use on small boats, a new streamlined bow light, including red and green lenses, is molded completely of plastic. The material used is weather-resistant butyrate; the housing will not rust or corrode and can take hard knocks without shattering or peeling. It requires no periodic refinishing.

Available in standard white or gray, and in four different special colors — red, blue, ivory, or green — the bow light comes complete with bulb, light socket, adaptor, screws, and templet for easy installation. A socket at the top of the housing accommodates any standard flagstaff.

Credits: Manufactured by Anchor Bay Plastics, Fair Haven, Mich., and distributed by Dee Zee Enterprises, New Baltimore, Mich., bow light is Tenite butyrate supplied by Eastman Chemical Products, Inc., Kingsport, Tenn.

P L A S T I C S

Noiseless catches of polyethylene



New molded polyethylene friction catches operate smoothly, noiselessly, and efficiently to hold cabinet doors tightly closed. The "working" part of the catch is a cuplike molded polyethylene piece, fastened to the underside of a cabinet shelf with two screws. As the cabinet is closed, the cup slips over a round-head screw fixed in the door (and lined up to meet properly) and grips it firmly by friction fit.

Replacing formed metal strips and springs, the polyethylene has toughness and resiliency which enables the cup to hold its shape and friction grip throughout long use.

Credits: Using Tenite polyethylene supplied by Eastman Chemical Products, Inc., Kingsport, Tenn., the friction catches are molded by Plastiglide Mfg. Corp., Santa Monica, Calif., for Jaybee Mfg. Corp., Los Angeles, Calif.

Reinforced plastics trays match dishes

Lightweight reinforced plastics serving trays are now being molded in twelve colors to match the color range of melamine dinnerware currently on the market. The trays are available in six sizes, up to 16 by 22 inches.

Matched-metal molded on 30-ton Royal hydraulic presses in single-cavity molds, the trays are reinforced around all four sides by a precision-formed frame of 7-gage wire which is molded-in and uniformly covered by the plastic. The trays will not warp, rot, or dent, and their smooth, nonporous surfaces are easily cleaned.

Credits: Selectron polyester—Pittsburgh Plate Glass Co., Pittsburgh, Pa.; Laminac polyester—American Cyanamid Co., New York, N.Y.; fibrous glass—Ferro Corp., Nashville, Tenn. Toteline trays manufactured by Molded Fiber Glass Tray Co., Linesville, Tenn.

PRODUCTS

Toy vegetables made of inflated vinyl

Appealing to a child's desire to play "go-to-market," colorful inflated toys made of shiny vinyl are designed to resemble fruits and vegetables. Available in the colors of the fruits and vegetables they resemble, a set includes a carrot, onion, tomato, and banana. The toys are soft, yet durable, and can do no harm even if thrown by small tots at furniture or playmates.

The new toys are fabricated of 10-gage vinyl sheeting. The material is first electronically sealed, then inflated and resealed. The set of four toys is packaged in a transparent polyethylene bag in which the toys can be stored when not in use.

Credits: Using Boltaflex vinyl sheeting, supplied by Bolta Products Inc., Lawrence, Mass., the toys are fabricated by Hendo Products Corp., Flushing, N.Y. Polyethylene bags supplied by Transparent Packaging Corp., New York.

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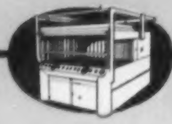

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Trapped-sheet forming

Oriented styrene sheet posed plastic memory problem that was solved by the development of a new technique

*By E. T. Aldington,† Paul S. Rath,‡ and Albert M. Tobia***

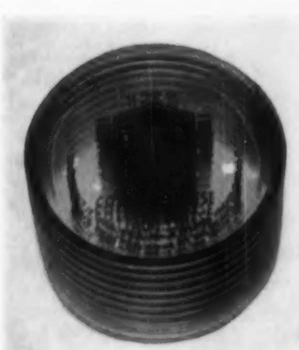
Transparent coverall type closures for food containers became a commercial reality when a maker of paper containers, a plastics materials supplier, a printer, and a machine maker all joined forces to create a new, eye-catching cover.

Stimulated by ready consumer acceptance of transparent food packages, the container maker searched for a closure that could satisfy these desires and that would not raise closure costs by more than 25 percent. The new cover had to be shaped to the coverall requirements of the sanitary code and manufactured from a material which is odorless, nontoxic, inert to foods, and which could impart no flavor to the container's contents. Also, to be useful, the closure had to be stiff, tough, and dimensionally stable over a range of temperatures from 0 to 150° F. Circular closures of three sizes were wanted.

Independently, Plax Corp. and Dixie Cup Co. had decided that Polyflex, a biaxially oriented polystyrene sheet produced by Plax, was the best available material for the job. But that was only the beginning. No machines existed that could form the sheet to the shapes wanted. In addition, there were doubts as to whether a thin sheet of Polyflex could be heated to a point where it would be soft enough for forming without sacrificing the desirable properties imparted to the styrene sheet by orientation. To probe all phases of the problem, a joint program was started in which Dixie Cup undertook to coordinate product development, printing, and blanking efforts, while Plax took on the difficult task of devising a method and machine for forming the printed blanks into finished lids.

For years, Dixie containers have been closed with paper clo-

*Reg. U. S. Pat. Off.
†Dixie Cup Co., Easton, Pa.
‡Plax Corp., Hartford, Conn.
**Bensing Brothers and Deeney, Philadelphia, Pa.



Transparent closures for food containers, formed of oriented styrene sheet, make eye-catching, sales-stimulating covers. They can be easily nested for economical shipment (left), can be imprinted with various sales messages and rim borders (center), and provide a tight container seal

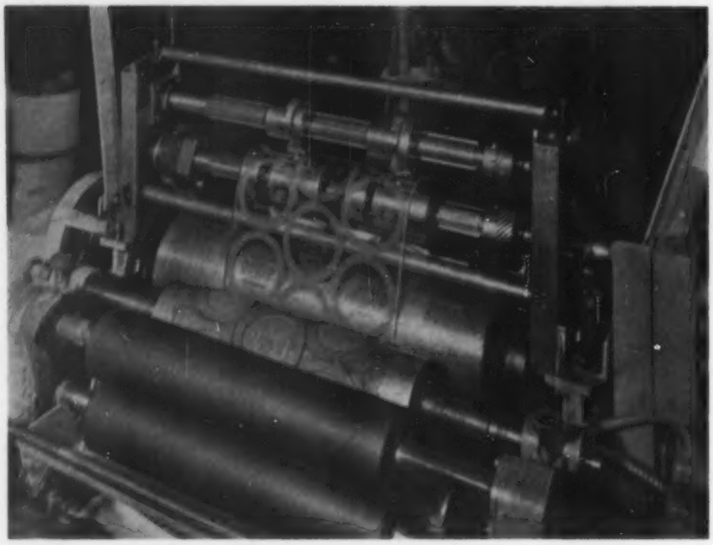


Fig. 1: Printing sheet for cottage cheese container closure. Rolls in foreground are fountain and transfer rolls which distribute ink to plate cylinder (center). Large impression roller (rear) supports the sheet as it receives the impression. Taken off by rolls and wheels at top, printed sheet goes to dryer. (Photo, Dixie Cup Co.)

sures having transparent film windows that are pressed down into the cup until they snap into a retaining groove. A strong, completely transparent lid was wanted that would give the potential customer a tempting view of the contents and which could be printed with sales messages. Dixie hoped that it would be possible to develop a one-piece closure which would give these advantages and which could be formed, for sanitary reasons, to cover the entire rim of the container.

Why Polyflex?

Rigidity is an important property in a container cover. It has long been known that molecular orientation increases the strength of plastics. A process of orientation and its effects has been discussed by Bailey[1] and Fortner.[2] Briefly, it consists of stressing the extruded sheet in both the direction of extrusion and the transverse direction and cooling the sheet while it is still under stress. This process partly uncoils and lines up the polymer molecules, and then "sets" them so that the finished sheet has a somewhat grid-like molecular structure, in contrast to the felt-like structure of unoriented sheet. Applied to polystyrene, the biaxial orienting process makes the sheet stronger, harder, and eight times tougher, and, therefore, gives it outstanding dimensional stability.

Oriented polystyrene was chosen for the study in the closure development program because, aside from its transparency, it combines many other wanted characteristics. Specifically, 1) it costs less than any other plastics for a given rigidity; 2) it offers good dimensional stability, toughness, aging resistance, and chemical resistance; and 3) it contains no plasticizers.

A sheet forming process was looked for in preference to injection molding, because of the better dimensional stability and other mechanical properties of the biaxially oriented sheet; also, the particular undercut shape that was wanted for the lids could not be satisfactorily ejected from an injection mold. Finally, the sheet forming process permits printing the sheet by the economical web-printing process before the blanks are punched out.

The Polyflex sheet must be handled carefully. Dust, process chips, or other particles on the film cause blemishes on the finished closures, so special precautions are taken to minimize particle pick-up. Because fingerprints on the stock appear as a whitish cloudy area on the finished closure, those operators who touch the material wear nylon gloves. The entire film-to-closures operation is separated from the general container factory area and the material is kept covered at all times.

Since Polyflex costs up to seven times as much as paper, and Dixie cannot directly re-use the material, waste must be kept to a minimum in all operations.

Process in a nutshell

As the sheet comes off the roll, it is printed in a flexographic press at a rate of 100 ft./minute. (See Fig. 1.) At the same time, holes are punched in the film which are later used to position it accurately for blanking. After the ink-wet sheet is passed through a drying oven, it is passed through chilled rolls to the rewinding station.

Rolls of printed, register-punched sheet are fed into the blanking machine where the disks are punched out and stacked. The disks are later loaded into the forming machines where they are shaped into finished closures by the "trapped-sheet" method and stacked for packing.

Process in detail

In the planning stages, there was a choice of printing the sheet—the "web," in printing-trade parlance—or of printing the individual closures after forming. Printing the blanks was also a possibility, but would have posed a serious drying and handling problem.

Printing the web offered several advantages: 1) It was possible to print the "skirt" or rim area of the covers, and so make them more attractive; this could not have been done after forming. 2) On printing runs over 50,000 closures, the web process offers greater economy. 3) With the cooperation of ink companies, a line of inks was developed that afforded the

[1]Bailey, J., India Rubber World *118*, 225 (May 1948).
[2]Fortner, C. P., SPE J. *9*, No. 5, 21 (May 1953).

opacity and range of color of postprinting inks.

There are several reasons why a flexographic press was chosen to print the sheet. There would frequently be short runs involving changes in the exact wording to be printed on the closures. Flexography was the only process by which such changes could be made economically. The printing of plastic sheeting is often complicated by the ease with which such materials stretch, giving rise to distorted print. Fortunately, this problem does not exist with Polyflex, which readily lends itself to distortion-free pre- and post-printing techniques. Dixie felt that flexographic presses were better suited to the material. In

Fig. 2a: Front view of blanking press in operation. Sheet stock is guided into the press by means of a pegged feed drum. Blanks are forced rearward by punches. Other side of machine is shown below. (Photo, Dixie Cup Co.)

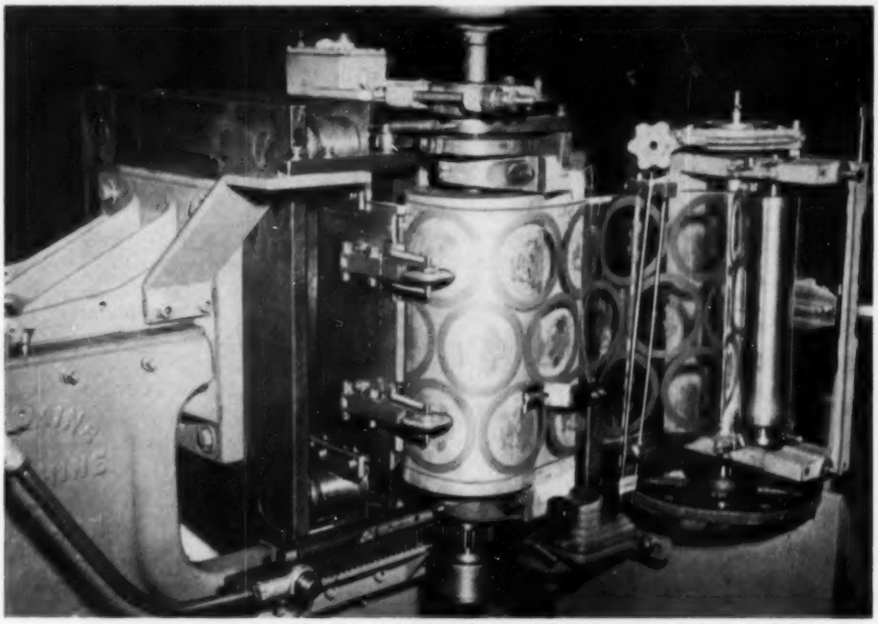
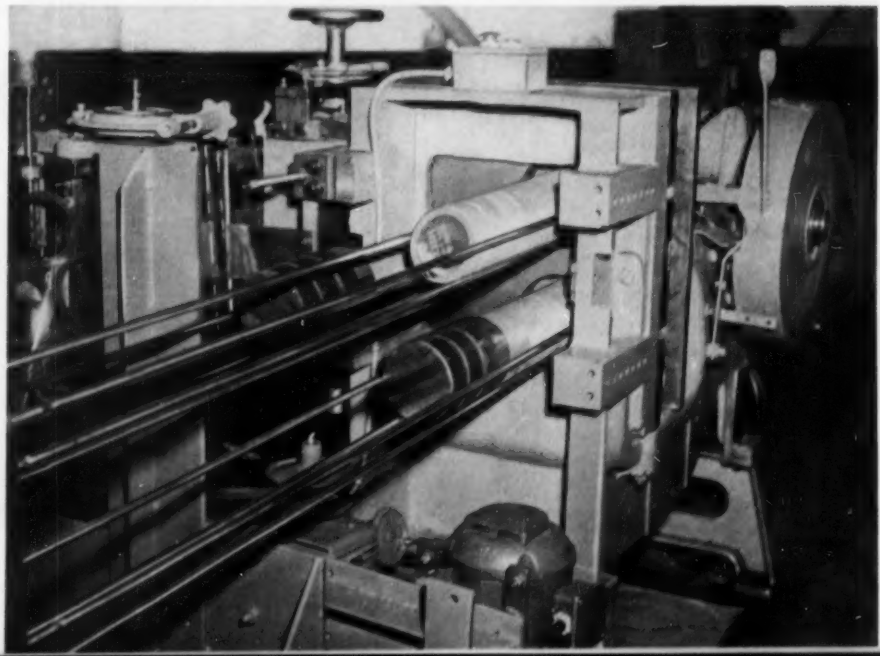


Fig. 2b: Rear view of blanking press. At left edge of photo, sheet enters guide rollers prior to alignment for the punching operation. New blanks can be seen stacked up on storage rails in center of picture. (Photo, Dixie Cup Co.)



addition, existing letterpress inks would be too difficult to adapt to the job.

Special inks

The inks used for printing the closures had to have an unusual combination of properties. They had to be insoluble in water and many food acids. Specifications called for the use of lead-free pigments. The dry ink film had to withstand the abrasion and thermal rigors encountered in both the forming process and end use. If the ink solvent attacked Polyflex, crazing and weakening would result. Finally, the inks had to have an appealing range of color.

Flexographic inks are mixtures of pigments, resins, and solvents that dry mainly by evaporation rather than by absorption. The resins used are normally thermoplastic and are not tacky once the solvent has evaporated; but, of course, they can't be heated to their softening points. If drying is incomplete or if the ink is resoftened during the oven-drying step, part of the ink will transfer or "offset" to the reverse side of the adjacent layer of film as it is rewound. On a transparent stock such as Polyflex this offset is ruinous, and during development many yards of sheet were spoiled before the correct ink formulation was found. Some formulas rubbed off during forming and some exerted a weakening solvent action on the sheet. Consultation with Bensing Brothers and Deeney on the aforementioned problems led to the establishment of the basic vehicle. Pigment manufacturers were consulted to establish the present broad color line.

Drying

Diaphane Corp., Philadelphia, Pa., the printers, use drying ovens that operate at 150°F. when drying printed Polyflex sheet. This temperature was arrived at by exhaustive tests of shrinkage. While Polyflex can be held at 175°F. for days with not more than 3% shrinkage, less than 1% shrinkage could be tolerated for the closure material to maintain registered blanking.

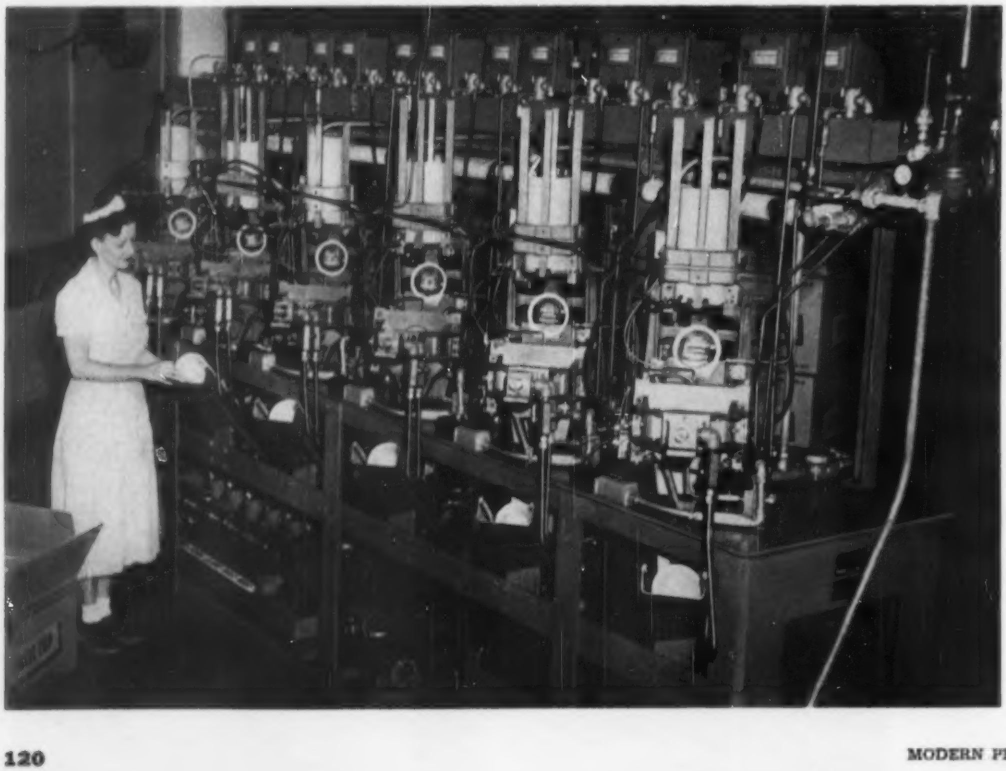
The final ink formula dries rapidly and completely at the oven temperature of 150°F. at production rates from 125 to 300 ft./minute. However, because Polyflex is supplied at present in small rolls, when compared with standard paper printing rolls, it takes as much time for a man to set up a new roll as it does to print a roll at the 100 ft./min. speed used.

As the sheet emerges from the oven it passes over cooling rolls that reduce the sheet temperature at rewind to about 100°F. At this temperature there is no danger of offset. Printing waste is only three percent.

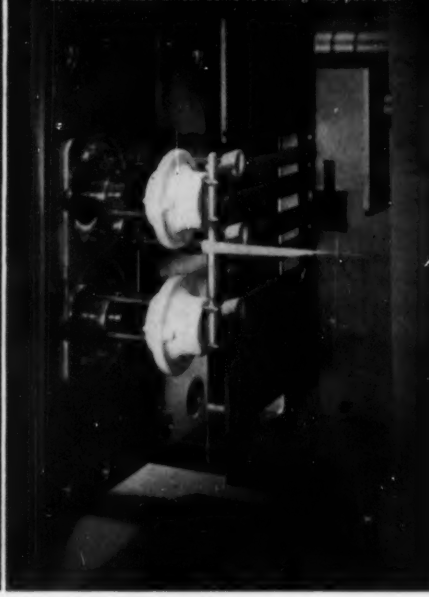
Blanking

To achieve low waste in punching the blanks on a conventional punch press, register holes are punched at the printing press, the blanks are printed in a close-packed layout, and a minimum of clearance is used between blanks. Trim waste was kept down to 16

Fig. 3: Operator removes finished closures from delivery chute. On machine, printed blanks are being dropped into position for forming. (Photo, Dixie Cup)



The press is fully open, showing a 5-cavity mold used to produce two different parts from an assembly.



The parts have been fully ejected and degated in one stroke; the mechanical comb is coming into position.

The pins retracted, finished parts ready to be packaged, sprue and runner fall into the discharge chute.

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This plastic part, used as a connector between wet mop and handle, could only have been made economically on a Stokes *truly automatic* injection molding machine.

Produced in small quantity by a custom molder, the part had to be competitive in price with the metal stamping it replaced. On a semi-automatic machine, labor cost per piece would be excessive because the small mold would limit production. If a large mold were used, mold cost per piece would be excessive because of the short run. On the Stokes 4-ounce injection molding machine, an inexpensive 4-cavity mold was used and automatic operation reduced labor cost per piece to a point at which the molder could secure the contract.

STOKES

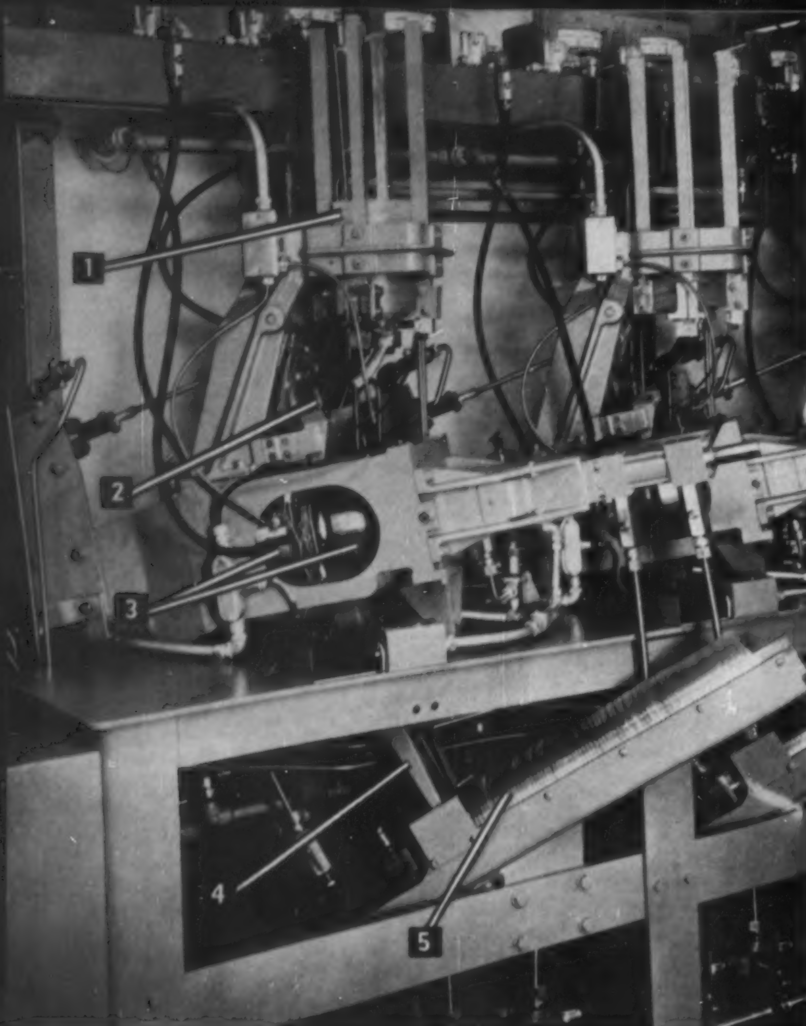


Fig. 4: Close-up of machine as it forms plain closures from unprinted sheet. When rim decorations are not desired, identification data are sometimes printed on closure after forming. 1—stacked blanks; 2—blank positioned to drop into mold, held by vacuum cup; 3—two halves of mold; 4—delivery chute; 5—formed closures.

Fig. 5: Schematic diagram of the operation of one unit of forming machine shown in photo at top of page. (Illustrations, Plax)

percent. Together with the forming waste, this trim is ground and sold to a scrap dealer.

Like most stiff stocks, the film fed to the punch press suffers from "curl" or "roll-set" because it has been stored in roll form. The die set of the press is designed to hold the stock flat during punching, and care is taken to feed the stock in such a manner that the curl is always in the same direction.

A pegged feed drum (Fig. 2a) picks up the perforated web and the disks are punched out and stacked automatically in horizontal racks (Fig. 2b). This stacking precludes scratching during handling and makes it easier to transport the blanks to the forming machinery.

To get clean-edged, particle-free blanks, the dies must be kept sharp and maintained to close tolerances. The press has interchangeable feeds and dies, so that it can blank all three sizes of closures efficiently. To minimize effects of static electricity, the press (and other machinery) is electrically grounded.

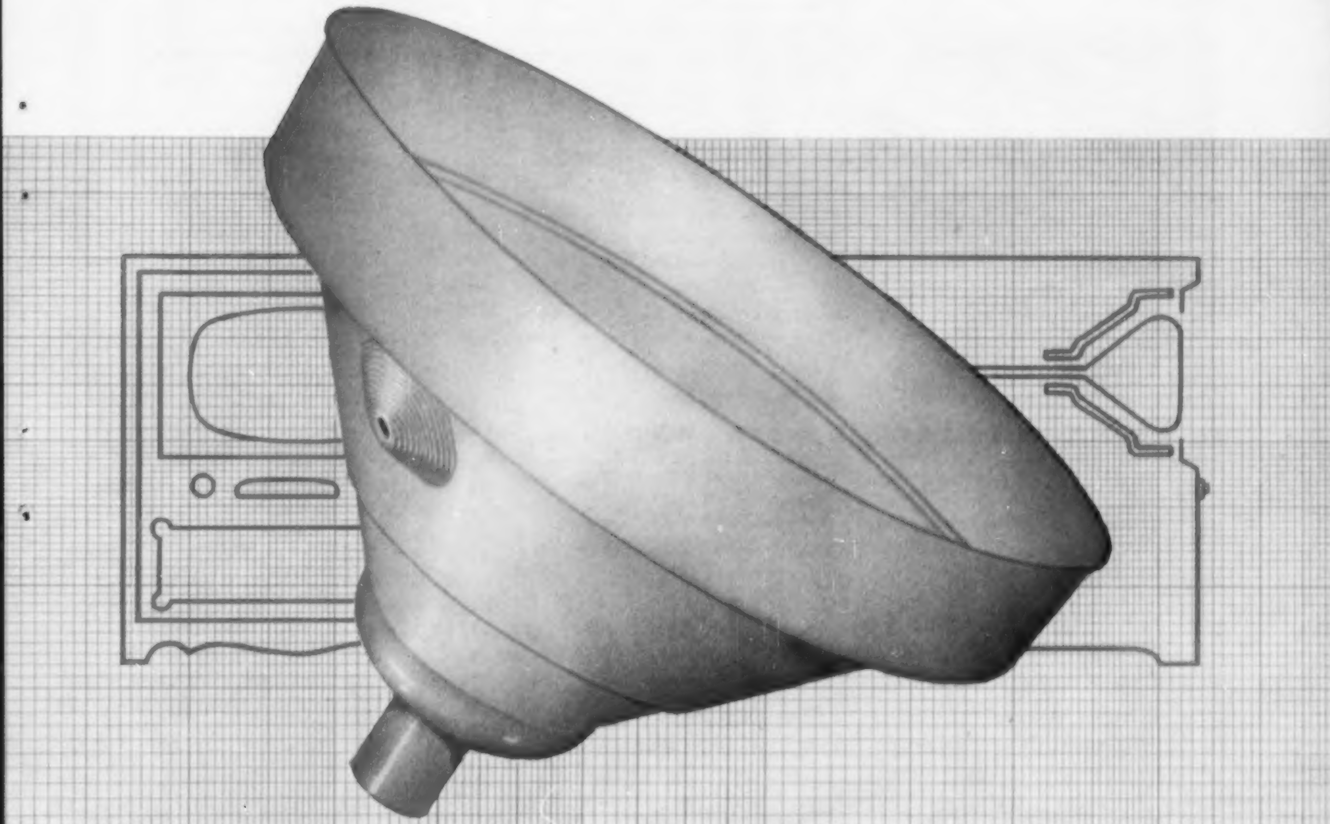
Forming the closures

Several methods of forming the food container covers were explored by Plax Corp. in their search for a practical process. The orientation of the sheet stock, so desirable in the finished product, becomes a formidable obstacle when attempts are made to form the sheet by conventional methods.

Oriented thermoplastic material contracts to its original extruded size and thickness when exposed to elevated temperatures. Although relatively little dimensional change takes place up to 180°F., at higher temperatures Polyflex undergoes "unmolding" because of its thermal plastic memory. Ultimate free unmolding, which takes place at above 250°F., will convert a disk of Polyflex 0.010 in. thick and 6 in. in diameter into a disk about nine times as thick and one-ninth the original area.

Since it was expected that forming temperatures up to 300°F. would be used, it was essential to find some way to restrain the heated Polyflex disks while they

Shield of **TENITE POLYETHYLENE** cushions color TV tubes... insulates against 25,000 volts



Shield molded for RCA Victor by Sinko Manufacturing & Tool Co., Chicago, Ill.

Polyethylene is finding new markets faster than any other plastic in history.

Typical of its ability to supply the right combination of properties for demanding jobs is this kinescope shield. Molded of Tenite Polyethylene, this shield surrounds RCA color TV picture tubes. This plastic was selected for its high dielectric strength to meet an operating voltage of 25,000 volts. In addition, its resilience cushions the tubes against mechanical shock during storage and handling. And no other plastic is easier to mold. The large complex shape of this shield was no problem for the molder.

Color television is just one of many industries—old and new—that has jobs for this versatile Eastman plastic. Tenite Polyethylene offers many interesting properties. It is odorless, tasteless and chemically inert. It remains flexible over a wide temperature range, and is virtually unbreakable. It saves weight in every application. It is tough, yet does not scratch delicate surfaces. Parts are easily made to any design by molding or extruding.

Perhaps something you make or buy could be given more sales appeal, better performance, or longer life if it were made of Tenite Polyethylene. For more information write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

TENITE
POLYETHYLENE
an Eastman plastic

were hot, and so prevent shrinkage. To do this, Plax engineers adopted the "trapped-sheet" forming process. Briefly, this consists of clamping the edge of the sheet and, with compressed air, forcing the rest of it against a heated surface; then, when the sheet is hot enough to form, the compressed air is reversed and the sheet is forced into a cooled mold cavity.

Forming machine developed

The "trapped-sheet" technique worked well in the laboratory, and it was decided to initiate a machinery development program to be carried out by Emhart Mfg. Co.[5] This work resulted in the EM-132 Sheet Plastic Forming Machine, and the first production units were purchased by Dixie Cup Co.

The EM-132 consists of six identical production units or heads mounted in line on a platform or bed. Each unit is actuated by a common hydraulic system, an oil-free source of compressed air, and a cam control mechanism. The mold temperatures are individually regulated and, because of the mechanical set-up, one or more heads may be left idle without upsetting the running of the others. The machine requires about 13 kw. of electrical power; compressed air at 60 and 300 p.s.i.; about 1 gal./min. of cooling water; and a source of low vacuum for the disk feeder. Figure 3 shows one of these machines with all six units forming closures. Figure 4 is a close-up of one unit forming unprinted disks.

The vital components of one unit of the EM-132 are schematically diagrammed in Fig. 5. The vacuum cup pulls the bottom disk off the waiting stack, tips it to the vertical position, then lets it fall into forming position against registry pins in the mold. The forming cover falls through a discharge chute and is stacked.

How it works

The six stages of the forming operation are shown in Fig. 6. In (a) the disk is positioned between the heated (left) and cooled (right) halves of the forming mold. The perimeter of the disk is clamped as the mold closes (b) and compressed air from holes in the cooled half forces the still-cold sheet against the hot surface. Thus the disk is heated progressively from the center, precluding the possibility of trapping of air

(*To page 242*)

[5] The work was a cooperative effort of the Central Research and Engineering Dept. of Emhart, Hartford, Conn., and Standard-Knapp Div. of Emhart, Portland, Conn.

Fig. 6: Schematic diagram of six stages of forming operation. (Illustration, Plax)

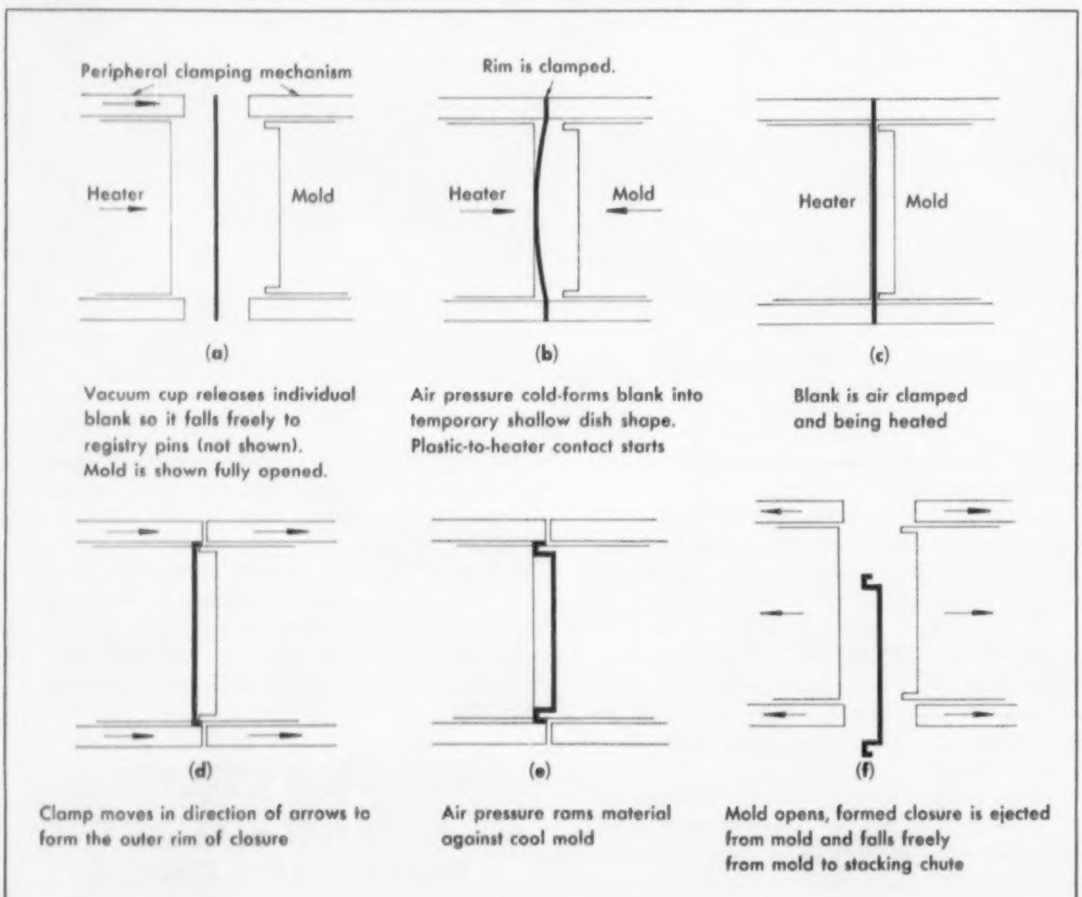


Fig. 1: Applying a "cementable Teflon" lining to a centrifuge made of stainless steel. Bonding was accomplished with a 92% solids epoxy-based mastic which cures at room temperature. Being slippery, Teflon lets centrifuged crystals, which are buttery and would tend to stick to stainless steel, slide down the chute. (Photo, E. R. Squibb Co.)

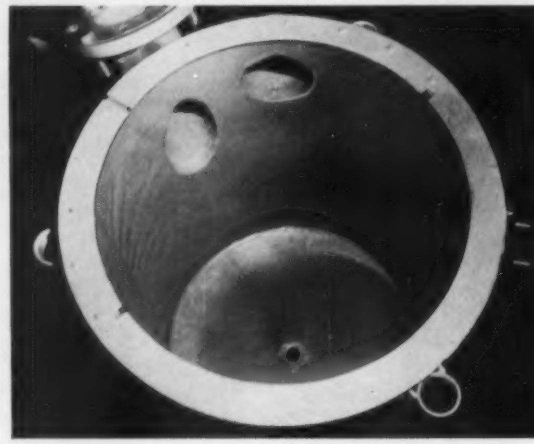


Fig. 2: Laminate of fibrous glass and polychlorotrifluoroethylene is bonded to metal vessel to protect metal from attack by acids, solvents, etc. An epoxy-based adhesive and a special hardener were used to allow room-temperature cure. (Photo, The M. W. Kellogg Co.)

Room-temperature bonding

New epoxy-based adhesives which need no heat cure offer new high-strength fastening possibilities for plastics and other components

*By Jerome L. Been**

Because of the development of new adhesives from new synthetic resins and elastomers, adhesive bonding is looking better and better to engineers as a fastening method in making composite products with plastics components. The reasons for this growing acceptance of adhesive bonding include:

1) "All-plastics" assemblies are frequently used where exposed metals must be avoided (Fig. 1) and metal fasteners such as screws or rivets cannot be used; or where, alternatively, the plastics may be used as coating materials to protect metals, as in applications where acid resistance is required. In such cases, an unbroken plastic surface is essential (Fig. 2).

2) The plastic may not be rigid enough to retain a metal fastener in a pierced hole if the joint is stressed.

3) It may not be strong enough to bear a reasonable load at a pierced hole on account of stress concentration.

4) Many plastics, and particularly the cross-linked or reinforced-thermosetting plastics, cannot be bonded to other materials or even to themselves by thermal welding or heat sealing techniques (Fig. 3).

There are many excellent reasons for using adhesive bonding with any materials including:

a) ability of adhesives to join dissimilar materials (Fig. 4);

b) elimination in many cases of the need for high temperatures during joining;

c) ability to fasten materials to very thin metal parts (Fig. 5);

d) sealing action of the adhesive bond;

e) vibration damping properties contributed by the adhesive;

f) ability to provide a heat- or electricity-insulating layer between two bonded surfaces;

g) uniform distribution of the bonding load over a large area;

h) smooth surface contour resulting from the bond;

i) reduced production costs through the utilization of less specialized personnel;

j) in many cases, reduced weight and increased service life.

In addition to these mechanical

*Vice president and technical director, Rubber & Asbestos Corp., Bloomfield, N. J.

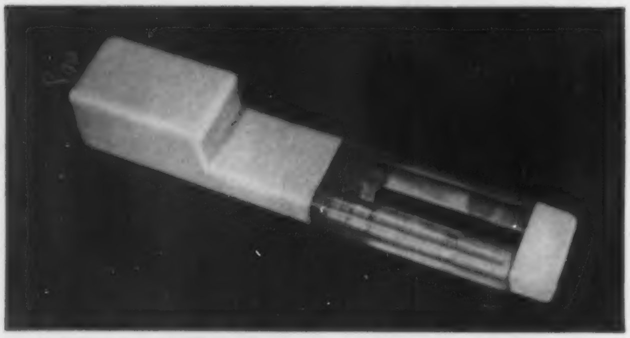


Fig. 3: Stroboscope tube component has an epoxy-acrylic butt joint. This joint could not have been made by heat-sealing or welding processes, or with metal fasteners, but was simple to make by adhesive bonding. The adhesive used was a 100% solids epoxy-based formulation that cures at room temperature. This bond had to withstand very severe tests: for example, it had to survive the shock of sudden changes in temperature (from −58 to 212° F.) while under load. (Photo, Aircraft Marine Products)

and cost advantages, the general chemical kinship of adhesives and plastics not only contributes to good specific adhesion to plastics, but also makes it possible for properly formulated adhesives to match closely these plastics in modulus, flexibility, toughness, strength, resistance to thermal degradation, coefficient of expansion, and solvent and chemical resistance.

While bonding requirements for flexible films or plastic foams may be met by many different types of adhesives, the available choice is greatly narrowed when the adhesive is to be used to bond structural, i.e., load-bearing plastics, particularly where resistance to heat is needed.

Thermoplastics may not be bonded with heat-set adhesives, for obvious reasons, with the few exceptions of those plastics with heat-distortion points well above the curing temperature. Even with thermosetting plastics, further heating to set the adhesive may result in undesirable changes in the properties of the plastic such as "over-cure embrittlement," disorientation, distortion, discoloration, and degradation.

This, of course, makes a strong case for the desirability of using cold-setting, or low-temperature-curing adhesives with both thermoplastic and thermosetting plastics. Excepted, of course, are those cases where the adhesive co-cures with the thermosetting plastic while the assembly is formed, e.g., copper-clad material for printed circuits (Fig. 6), aluminum foil in decorative-laminate table tops, etc.

Use of solvent-based adhesives to bond plastics at low temperatures is quite common. Among the familiar types available are:

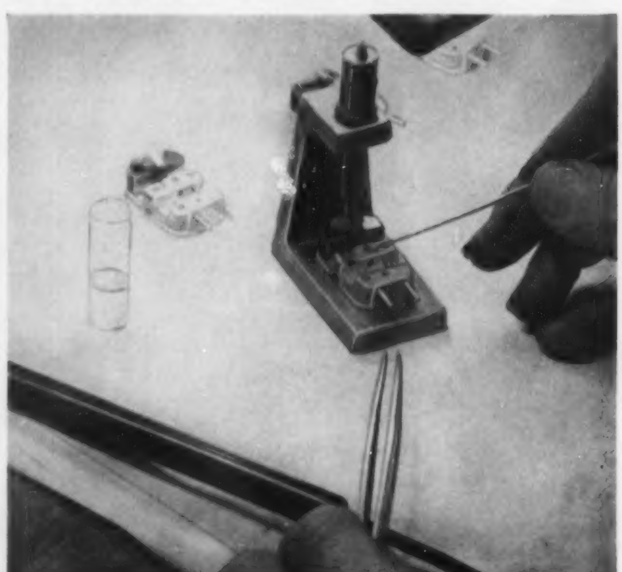
1) Lacquers consisting of solutions of resinous high-polymeric film-formers with or without tackifiers and plasticizers. Typical of such formulations are Duco cement, Bakelite's Vinylseal, Acryloid B72, and Bondmaster L254.

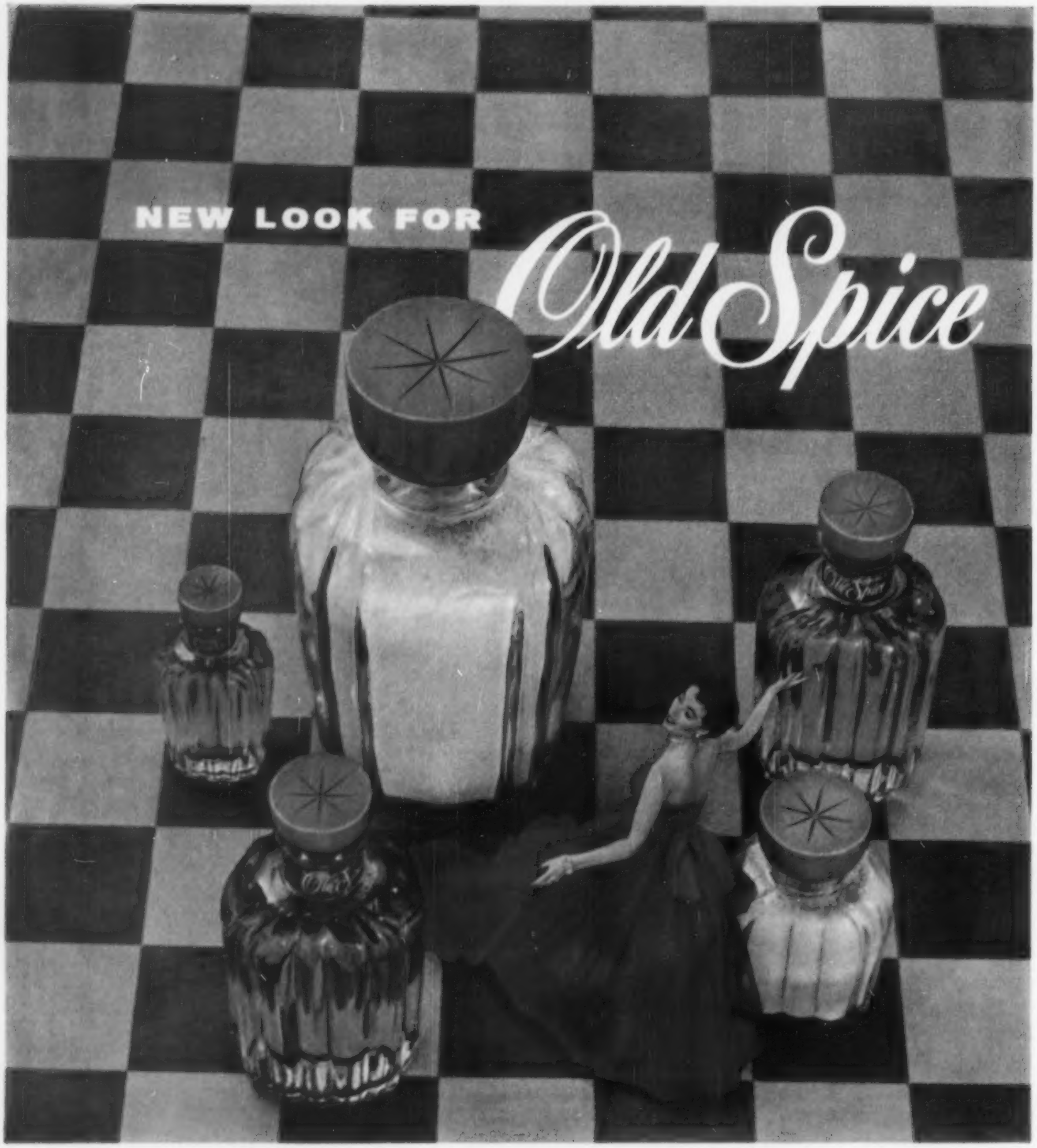
2) Elastomer-based adhesives consisting of solutions of elastomer-plasticized "plastic" resins, or elastomers as the film-former, with tackifying or reinforcing resins. Typical of such products are Pliobond, 3M's EC711, and Bondmaster G580 and M373.

Interesting variations in the formulation of this latter type of adhesive may be the use of "ultra-acceleration" systems active at room temperature, which improve bond strength and slightly decrease creep of the bond at elevated service temperatures, and the use of isocyanates as modifiers to change specific adhesion characteristics and provide a fair degree of "cure." Sometimes such

(*To page* 133)

Fig. 4: Playback cartridge assembly is made of Mylar film, aluminum, mu-metal, sintered iron, Alnico magnets, Kralastic, 1-mil copper wire, rubber, and silver-plated brass—and the entire product measures less than 1 sq. inch. The adhesive used in this application is a 55% solids epoxy-polyamide combination of extremely low viscosity (120 centipoises). Time for curing ranges from 24 hr. at room temperature to as little as 60 min. for cures at a temperature of 212° F. (Photo, Fairchild Recording Instrument Co.)





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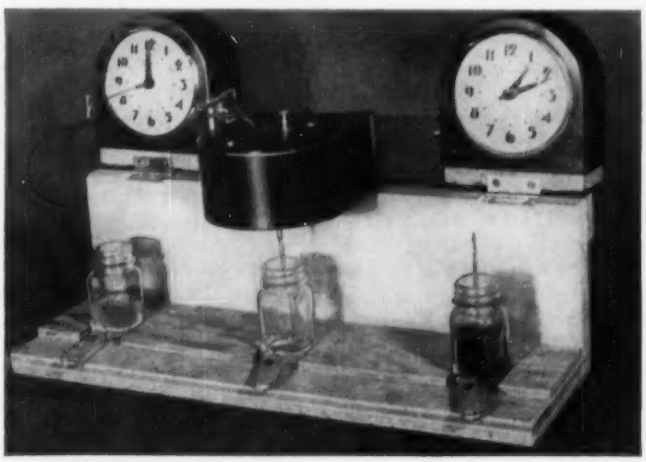
resins are applied in film form, either unsupported or supported on fabric, glass mat, etc., and conveniently used with solvent reactivation to save drying of a large volume of solvent and to provide better peel through the reinforcement by the carrier (Fig. 7).

Generally speaking, the use of non-curing solvent-based adhesives is limited to applications where only moderate strengths are sought and where the solvent does not harm the plastic to be bonded. Typical of such bond strengths are those demanded by Specification MIL-C-4003 for vinyl-to-aluminum bonds, where the peel strength is required to be a mere 5 to 10 lb./inch. Also typical is Specification MIL-A-5092A, where tensile shear strengths are required to be at least 150 p.s.i.

Tensile shear strength is really a shear strength measured in this way: the materials to be bonded are bonded in a short lap joint, then the two ends of the resulting strip are pulled until the bond shears. (The bond is made short enough so that the bond, rather than the bonded material, fails.) The force required to break the bond, divided by the bonded area, equals the tensile shear strength in p.s.i.

Cured thermosetting plastics such as phenolics, urea, epoxy, melamine, polyester, hard rubber, etc., are generally highly resistant to solvents and can be bonded with adhesives containing aggressive solvents (Fig. 8). Many thermoplastic polymers (styrene, acrylics, vinyl) are readily swelled, crazed, or even dissolved by many solvents, and great care must be exercised in choosing solvents for adhesives used to bond them. For example, if these plastics are in thin-film or foam form (Fig. 9), solvent attack may be disastrous.

Occasionally, active solvents may be used with heavy, rigid thermoplastics where the bonded swollen surface will not be exposed to view and where loss of cohesive strength of the attacked plastic is well within acceptable limits for the end-product (Fig. 10). On the other hand, solvent welding of vinyls, etc., properly performed, is very effective and in widespread use.



Three clock viscometers: One at left is ready for use, center one is in operating position, rotor of one at right has stopped in gelled sample after 72 minutes. Hinge-mounting makes tilting possible. (Photo, Bjorksten Research Labs.)

Clock-viscometer measures pot life

A simple device for estimating the pot life of adhesives from small samples has been developed by Bjorksten Research Labs., Inc., Madison, Wis. It consists essentially of an electric clock with a simple chuck soldered to the shaft driving the second hand. In this chuck are inserted expendable paddles, or rotors, of 0.087-in. aluminum wire bent to an S-shaped loop at one end and flattened at the other end to fit the chuck. The clock is mounted on a hinge so that it can be tilted over when measurement is begun. The electric clock of the pot life meter is started and the aluminum wire attached to the clock is inserted into the adhesive mix. As the mixture thickens and sets, it seizes and halts the aluminum rotor and stops the clock, which thus records the gel time, or pot life of the adhesive, to the nearest minute.

Solvent-free adhesives

Many synthetic resins in "100% solids" form have been evaluated as adhesives. The acid-cured phenolic casting resins were found to be brittle and to exhibit high shrinkage and relatively limited specific adhesion. Adhesives based on silicones, monomer-hardener systems, or isocyanate-alkyds are currently under investigation but their adaptability for general-purpose use has not yet been demonstrated. The outstanding formulations in the field of "100% solids," solvent-free reactive adhesives, are those based on epoxy resins.

The formulation of epoxy-resin adhesives has advanced far in the past few years. The use of polymeric hardeners, such as polyamides and polyamines, phenolics, isocyanates, alkyds, Thiokol-amine combinations, etc., and the practice of "alloying" with compatible polymeric film-formers such as polyvinyl acetate and certain elastomers, have led to the development of a large group of adhesives with a wide range of properties. They are characterized generally by toughness, high cohesion, and the broadest spectrum of specific adhesion. They are well suited to bonding many plastics.

By the selection of the proper hardener (monomeric, polymeric

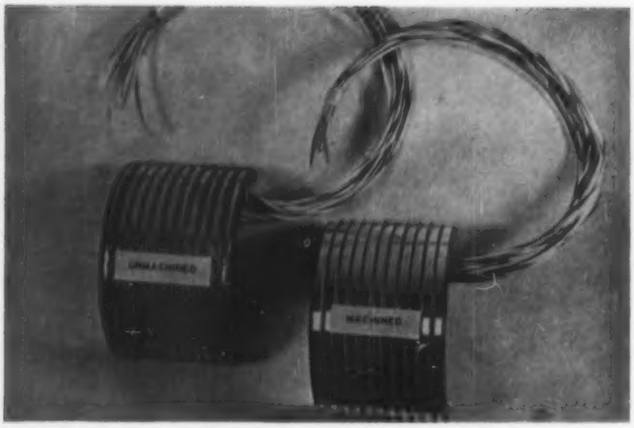


Fig. 5: Two slip-ring assemblies in last stages of completion. Each consists of 11 coin-silver slip rings bonded to a cotton-base laminated phenolic barrier using an epoxy-type adhesive. Adhesive is hand-applied to both silver and laminate surfaces, which were clamped together to prevent movement, and then heat-cured at 150° F. for 30 minutes. (Photo, Norden-Ketay Corp.)

or mixed)—several chemical families of varying reactivity are available—room-temperature, low-temperature, or elevated-temperature cure cycles may be obtained.

Room-temperature curing

Epoxy-based adhesives exist today which are not only capable of being cured at room temperature but which actually yield tensile strengths which are often far greater than those obtainable after high-heat curing with non-epoxy adhesives. However, the use of a room-temperature curing epoxy-based adhesive usually imposes the following important limitations:

1) A two-part system, consisting of resin plus hardener (there is no such thing as a one-component epoxy *room-temperature curing* adhesive—for obvious reasons); 2) limited pot life of the mixed materials . . . or 3) long curing time to achieve optimum bond characteristics; and 4) limited high-temperature service.

A relatively limited pot life is inherent in most such systems. If the catalyst is to provide a fast cure, it will start the curing action just as soon as it is mixed with the resin. That, in turn, means short working life of the mixed materials.

If a longer pot life in the mixed adhesive is essential for the production cycle, the formulator must provide a slower-acting hardener. And that, of course, delays cure.

To get longest pot life

To get top pot life, three simple rules should be observed.

1) Start with a cool mixture and work in a cool room.

2) Mix no more than necessary at one time.

3) Mix the materials in a shallow, oversize, metal container and work from this container.

The curing of an epoxy resin is a chemical reaction that liberates heat—an exothermic reaction. Unless this heat can escape from the resin to the surroundings, it heats the resin and the cure goes faster. As the cure goes faster, the rate at which heat is evolved increases, the mixture gets even hotter, and so on. The problem is to hold down the rate of curing in the pot. This can be done by starting out at a low temperature, by keeping to a

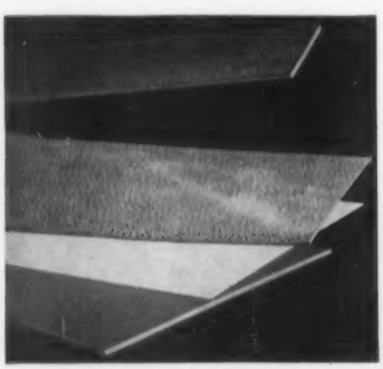


Fig. 7: Vinyl film is bonded to polyester board and to aluminum by means of a glass mat-reinforced adhesive film. The adhesive film may be solvent- or adhesive-reactivated and yields bonds that cure at room temperature and that are characterized by a relatively high peel strength. (Photo, Rubber & Asbestos)

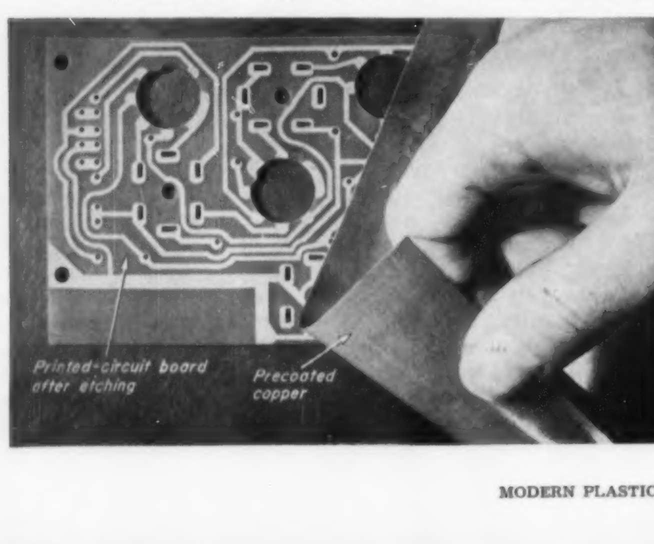
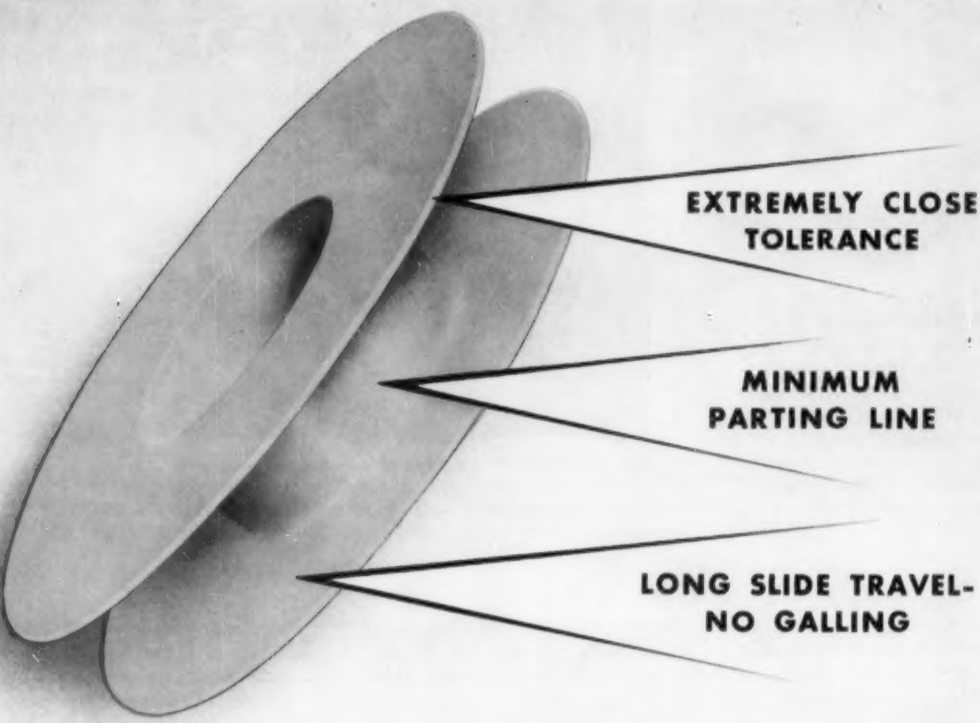


Fig. 6: Adhesive-coated copper used in printed circuitry is bonded to phenolic or epoxy base in standard heat-and-pressure cycle used to cure the plastic, permitting entire assembly to be produced in one operation. (Photo, Rubber & Asbestos Corp.)



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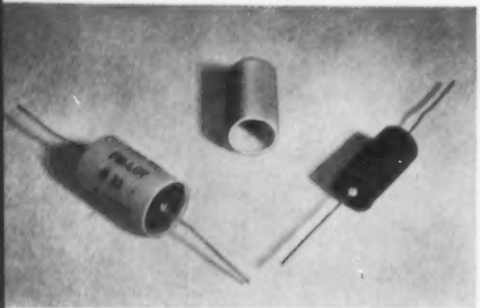


Fig. 8: Vulcan coil consists of a phenolic sleeve bonded to hard rubber to make a hermetic seal. Bonding is done with a solvent-type general-purpose adhesive containing 20% solids. Permissible curing cycles range from 8 days at room temperature down to 20 min. or less at temperatures in the range of 300 to 500° F. (Photo, Fugle-Miller)

Fig. 9: Sandwich assembly of polyester skin bonded to polystyrene-foam core, using a room-temperature curing, 100% solids epoxy-based adhesive formulation; this solvent-free adhesive is a clear, low-viscosity liquid. (Photo, Haskelite Mfg. Co.)

minimum the total amount of heat generated, and by making it easy for this heat of reaction to escape. Thus the work should be done with a small total volume, this volume should be spread over a large area of contact with the surroundings, the surroundings should be kept cool, and the transfer of heat should be speeded by using metal containers.

The curves in Fig. 11 show the viscosity in the pot of the mixed resin versus time for three different batches. Curve *A* represents the behavior of a 330-g. batch of Bondmaster M648 mixed at 77° F. In 1 hr. it reaches a viscosity of 75,000 cp. Curve *B*, representing a 1000-g. batch of the same resin mixed at the same temperature, rises more steeply and after 60 min. has a viscosity over 400,000 cp. Curve *C* represents a 330-g. batch mixed at 100° F., and it rises even more steeply than the others.

While these graphs are typical of a great many epoxy adhesives, it should be kept in mind that many factors affect pot life. Examples of these are the composition of the resin, the type of catalyst, and the ratio of mixing. In support of the rules given above there is this fact: many large users of epoxies find it more economical to mix several smaller batches per shift than to risk premature "setting-up" of the adhesive.

If it is necessary to store mixed materials for any reason (and every effort should be made to avoid storing them), they should be kept in a refrigerator.

There is one quite different approach to the pot-life problem: do away with the pot! It should be possible to continuously meter, mix, and dispense the adhesive as it is needed instead of preparing batches. Equipment to do this, expressly designed for materials having short pot lives, is now being intensively investigated by the adhesives industry.

Heat speeds curing

Almost all room-temperature curing epoxy-based formulations can be cured faster by the application of a little heat. Consider a typical resin that would ordinarily require a full week at room temperature to attain its fully cured strength. Curing begins as soon as the resin and catalyst are mixed, and, in many cases, the bond will be strong enough to withstand handling (and stocking) within 6 hours. This rapid gain in strength in the early hours of a week-long cure often goes unmentioned in manufacturers' data sheets. When heat is used to speed the cure, it need be applied only long enough for the bond to reach "handling strength."

A plot of time required to cure to 85% of maximum strength versus curing temperature is given in Fig. 12 for a typical resin. (The data represent one of many tests. Repeated tests give similar but not identical results.) Note

Fig. 10: Colorful styrene toy microphone housing is bonded to Alnico magnets and to steel with a solvent-based adhesive, which provides adequate strength for this application. As the bonds are inside the housing, the pleasing outside finish is not marred by the action of the solvent on the polystyrene. (Photo, Remco Industries)

FIG. 11

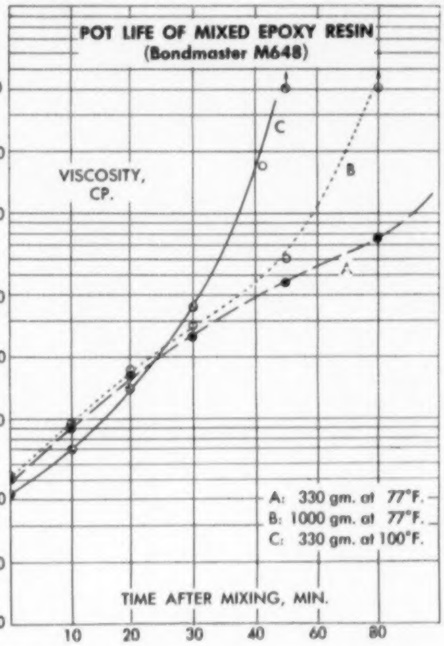
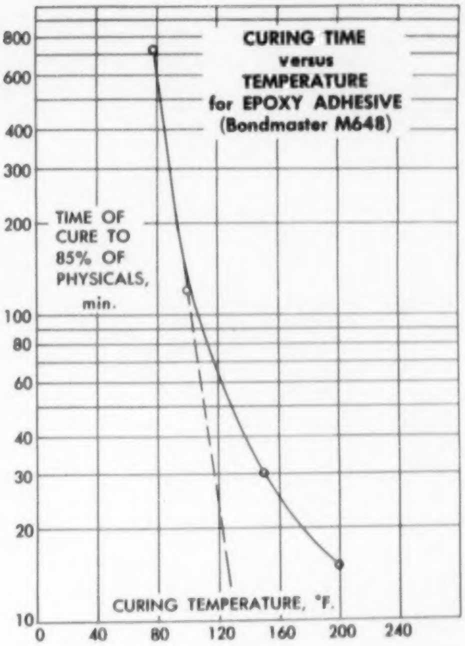


FIG. 12

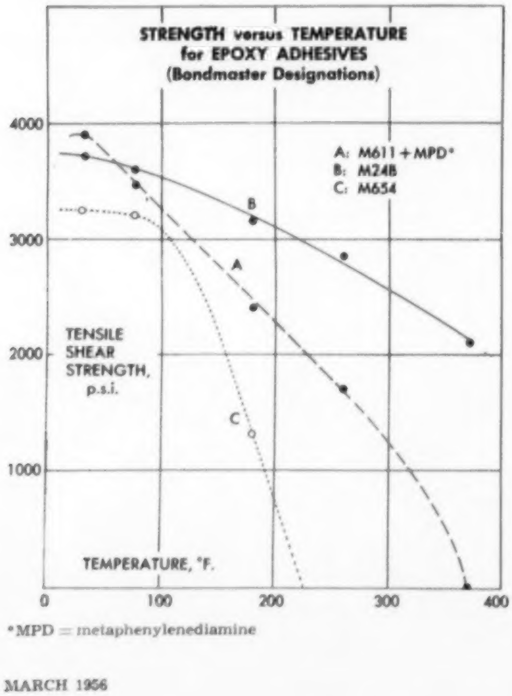


that the curve slopes very steeply at the lower temperatures but gradually becomes less steep at the higher temperatures. If the cure were carried to exactly the same degree of completion at all temperatures, it would be expected from the theory of chemical reaction rates that the curve would be nearly straight, like the dashed line.

However, some of the amine catalyst is lost by vaporization at the higher temperatures, and the rate suffers. Another factor is the partial permanent loss of strength of some resins due to degradation at the higher temperatures. To offset this loss of strength, the resin must be more highly cured at the higher temperatures to reach the same strength. For these reasons, the actual curing time is considerably longer than would be expected from extrapolation of the low-temperature rates.

In spite of degradation and loss of catalyst, the curing time can be sharply reduced by raising the temperature.

FIG. 13



*MPD = metaphenylenediamine

Cost of heat resistance

Retention of high strength in the cured bonds at elevated temperatures requires the development of specially resistant adhesives. Not only must the development costs be amortized in the price of the product, but the very equipment and procedures used for control testing are more expensive than those used with "normal-temperature" adhesives. In addition, many of the resins used in these specialized adhesives are themselves costly. Those formulations which must conform to strict Government specifications involve special handling and expensive testing in every stage of their manufacture.

(To page 244)

Automatic molding of coil forms

Lowered production cost is achieved by use of split molds in modified compression press

Coil forms—small spool-shaped parts with wafer-thin ends—are conventionally produced from thermosetting resins by semi-automatic compression molding. The finished forms are removed from the presses by hand. Now, for the first time, the Appliance Control Dept. of General Electric Co., Morrison, Ill., is molding these forms on a fully automatic cycle. They were able to do this by using a split mold with a modified 50-ton Stokes Model 741 press.

The change was made to reduce costs. The only apparent way to do this was to cut the amount of labor required to produce each piece. Consultation between engineers of G.E. and F.J. Stokes Machine Co., Inc., Philadelphia, Pa., resulted in the development of a method of automatically ejecting the molded forms. The split mold was made, the press was modified to the method, and the setup is now producing 360 forms per hr. at a cost of less than ¼¢ each.

These coil forms, molded of general-purpose phenolic resin, are 0.750 in. high; the flanges are 0.062 in. thick and have an O.D. of 1.156 in.; the hubs have an I.D. of 0.442 in. and walls 0.050 in. thick. Material cost for these spools, which weigh 3.8 g. each, is $1.68 per thousand. Molding them on a 1-min. cycle in a six-cavity mold costs $2.35 per thousand, not counting overhead and amortization of the press and mold. This is about half the cost of molding them in a semi-automatic press. The operating cost is low because only a fraction of one operator's time is needed to load the feed hopper and remove the forms.

Side-draw used

Because of the side-draw motion needed to free the pieces from the mold, the mold cavities

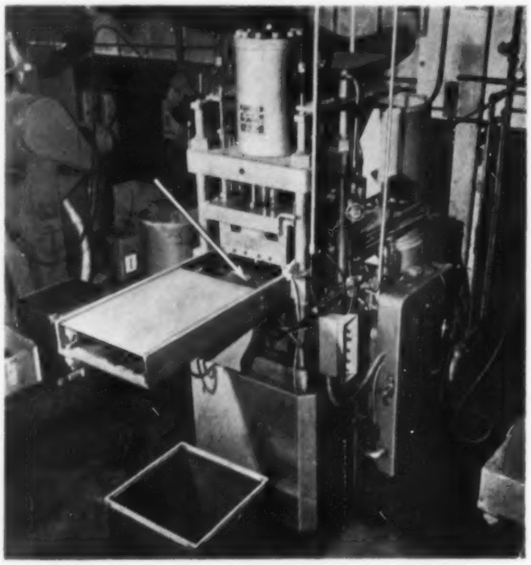
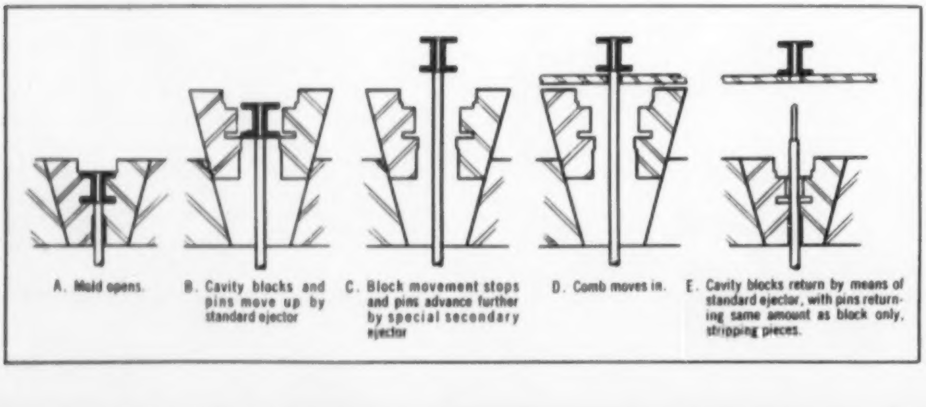


Fig. 1: Automatic molding press. Comb (arrow) strips coil forms from top of ejector pins

Fig. 2: Schematic representation of successive stages in operation of split mold during automatic compression molding



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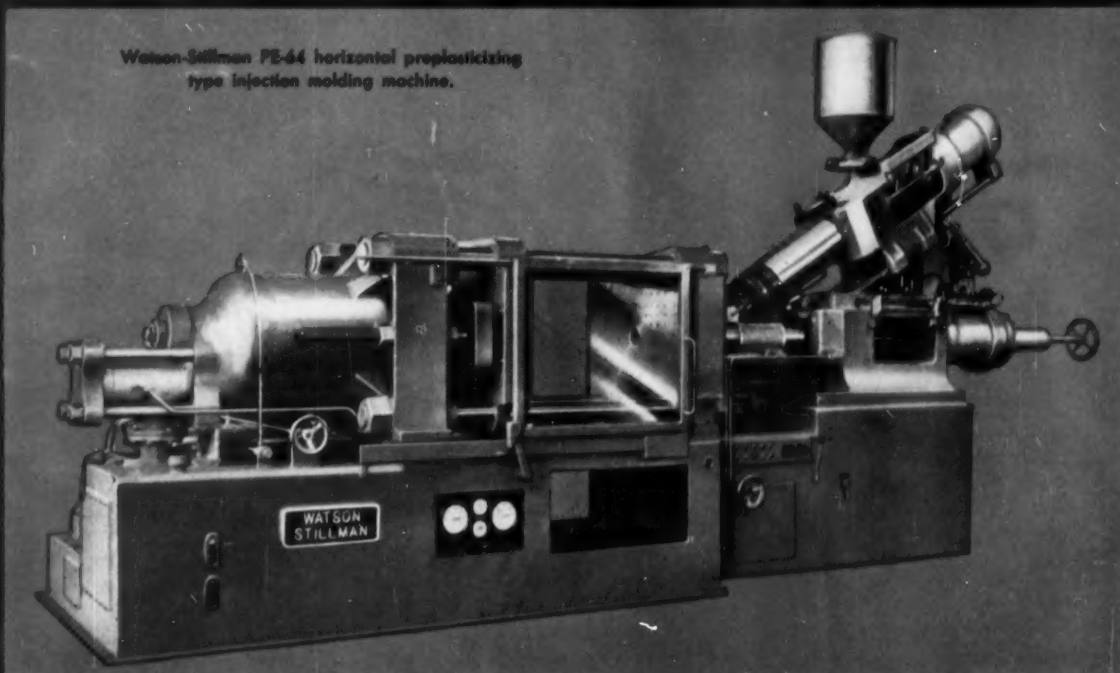

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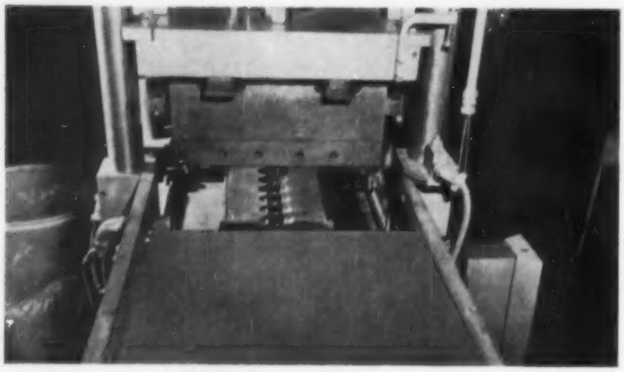


Fig. 3: Close-up view of the mold as it begins to open. The two halves are just beginning to draw apart

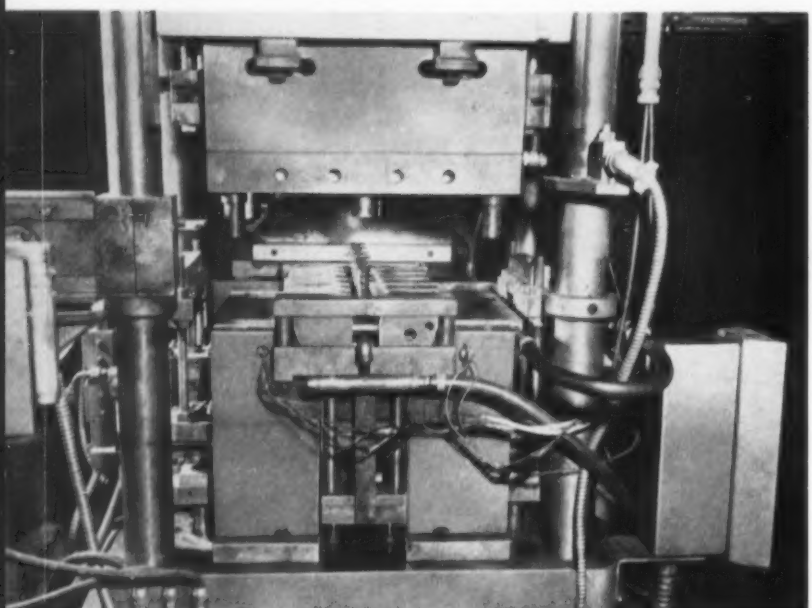


Fig. 4: Close-up view of fully opened mold. Coil forms (center of photo) are raised on ejector pins. (All illustrations, Stokes)

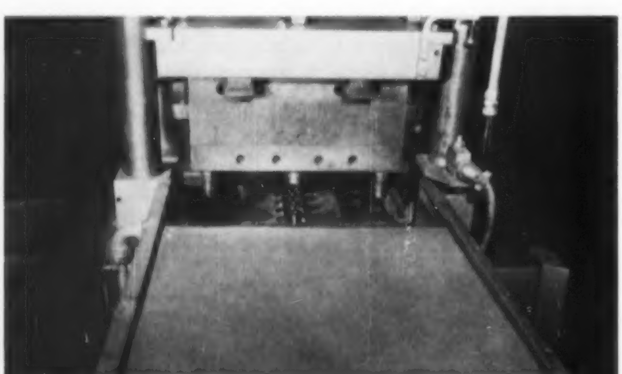


Fig. 5: Close-up of mold as side blocks begin to close, with comb moving in to strip coil forms from ejector pins

had to be arranged in a single row which runs from the front to the back of the platen. This arrangement does not utilize the full 50-ton capacity or the whole platen area of the press, but the split cavity motions require an oversize mold and, therefore, an oversize press. Figure 1 shows the new automatic press as installed in the G.E. plant.

Successive stages in the operation of the split coil-form mold are shown schematically in Figs. 2A through 2E. In 2A is a cross-section of one of the cavities of the mold with a molded piece in it and with the top half already withdrawn. As the mold opens further, the main hydraulic ejector cylinder in the bottom of the press forces the cavity block and the ejector pin upward together, the side-draw device causing the core blocks to separate (2B) as they rise. Next, two additional hydraulic cylinders continue (2C) to raise the coil form on the central ejector pin after the cavity blocks have stopped rising. As in 2D, this raises the spools above the tops of the core blocks so that they can be automatically picked off by the approaching comb. Finally, the main ejector cylinder descends, lowering the pin and allowing the comb to strip off the pieces (2E). The secondary cylinders then retract the ejector pin to its original position. Figures 3 through 5 show the actual mold at different stages of the cycle.

An important feature of this new mold and press set-up is an extremely sensitive detector that stops the automatic cycling in the event that an accumulation of flash prevents the split mold from returning to its fully closed position.

Stokes engineers are of the opinion that this method of automatic compression molding with split molds can be adapted to the fast and economical production of a variety of shapes. And, as a result of their pioneer work on the coil-foil problem, a fully automatic press can now be offered into which are designed all the extra motions needed to control a split mold, complete with necessary controls for sequence timing and safety devices.

Weigh feeding makes possible cycle reduction in molding styrene refrigerator component (left), assures uniform wall thickness in molded TV mask (right). (Photos courtesy The Exact Weight Scale Co.)

A report on weigh feeding

Injection molder cites specific examples of savings directly attributable to change-over from volumetric feeding

Simply by changing over from volumetric to weigh feeding, one injection molder testifies that an over-all cycle reduction of almost 30% has been achieved. The advantages inherent in the use of weigh feeding devices in injection molding have been discussed previously in MODERN PLASTICS Magazine, but this is the first time that we have been able to report a specific increase in efficiency of this high order.

The report comes from Charles Catalde, president of Buffalo Molded Plastics Co. and is bolstered by data pertaining to the molding of transparent polystyrene vegetable pan covers for refrigerators and translucent television masks for a 21-in. set.

In the case of the vegetable pan covers, Mr. Catalde reports not only a reduction in molding cycle, but also the virtual elimination of rejects. When using volumetric feeding, the over-all molding cycle was 72 sec.; with weigh feeding, this was reduced to 52 seconds. When using volumetric feeding, production during an 8-hr. shift was 400 pieces and rejects averaged 15%, or 60 pieces per shift, making an actual production total of only 340; with weigh feeding, production increased to 550 pieces and rejects dropped to zero. Thus, production per 8-hr. shift increased by 210 pieces, to bring about an astounding efficiency increase of over 60 percent.

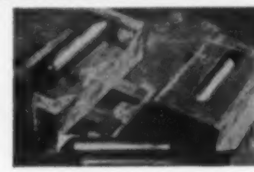
Additional savings are also reported: actual weight of the finished cover was reduced from 22 oz. to 18¾ oz., and die maintenance dropped almost to the vanishing point. The reason for the reduction in the weight of the piece is that no packing occurs in the injection machine when weigh feeding devices in injection molding are properly employed.

In the case of the translucent television mask, similar cycle figures cannot be given since the piece had not previously been run with volumetric feeding. However, the rigid specifications as to uniformity of wall thickness might ordinarily lead to high rejects; Mr. Catalde states that to date there have been no rejects whatsoever due to variations in wall thickness and he attributed this excellent result directly to the use of weigh feeding. The reason for the necessity for uniform wall thicknesses is that the material must transmit light from neon bulbs set behind the masks; any variations in wall thickness would show up as undesirable dark or light areas on the mask.

Credit: Weigh feeder equipment supplied by The Exact Weight Scale Co., Columbus, Ohio.

Cost savings of over $60,000 were achieved by a major automobile manufacturer in a single phase of prototype development of new-model cars . . . through using Marblette epoxy and phenolic resins for readily available and easily handled hammer forms and other tools and dies.

Time savings rewarded the nation's leading auto body producer through quick casting of sturdy draw dies faced with Marblette epoxy 602 laminated with fibrous glass, with cores of cold-setting epoxy 616. This tool determined a complicated part's die design.



Delays are minimized as Glennie Industries (Romulus, Mich.) finds draw dies like these suitable for production runs of up to 20,000 panels. For additional runs, plastic dies can be renewed in 48 hours by simple refacing.

Design changes in production pieces are easily incorporated in any of these epoxy tools, by chipping back and recasting any area of the die.

Marblette Resins Help Create "The Modern Look" in Plastic Tooling

Today's emphasis on redesign in the automotive, aircraft, and many other industries has spurred the trend to strong, light-weight plastic tools that reduce lead time and manual labor, cut costs as much as 70% . . . reproduce even the minutest detail . . . make possible new products and new models with minimum interruption of production runs.

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Marblette's superior line of epoxy resins offer heightened advantages in strength, light weight, long shelf life, handling ease, dimensional stability, and lessened dermatitis risk . . . include potting and casting resins, laminating resins, surface coat, resins for trowelling and sealing, and general-purpose resins.

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Liquid phenolic resins produced by Marblette include casting resins for tools and dies, heat and acid resistant resins, bonding resins, metal coatings, insulating varnish, bristle setting cement, laminating varnish, wood coating, plastic cements, sealing resins, foam resins and resin foundry core binders.

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Non-destructive mechanical

Test for degradation

Part I: Degradation study

By C. D. Doyle†

A low-amplitude vibrational test proved eminently satisfactory as a non-destructive method for measuring the decline of mechanical properties during heat-aging of a glass cloth laminate made with a triallyl cyanurate polyester. The program required 1/40 as many specimens as would be needed for a comparable conventional study. The change in resonant frequency was regular and indicated that the degradation process is diffusion-controlled, with an apparent activation energy of 22.6 kilocalories. The damping capacity history was characterized by temperature-dependent events, which reflected significant changes in mechanical properties and aided in estimating useful life. The 20-year life, continuous operating temperature limit for this laminate is of the order of 120 to 130° C. (by extrapolation).

In determining the life-temperature characteristics of solid structural materials, it is desirable to express life in terms of retention of mechanical properties. Ordinarily, mechanical properties are probed by breaking groups of samples from time to time during aging schedules at a few elevated temperatures. This procedure is generally unsatisfactory because it is rarely feasible to test enough samples at sufficiently frequent time periods and at enough aging temperatures to insure reasonably certain conclusions. Consequently, non-destructive probing tests that bear directly on mechanical integrity are actively being sought. One such test, based on low-amplitude vibration, is the subject of this report.

The material studied was a laminate made with glass cloth and a polyester,[1] having a nominal thickness of 1/8 inch. The resinous binder, a triallyl cyanurate-glycol maleate polyester, constituted 25 to 30% of the total weight of the laminate. Reed-shaped specimens were cut as described in Part II (see p. 148) of this report. Duplicate specimens were aged in forced convection air ovens at 180, 200, 220, and 240° C. From time to time, specimens were cooled for at least 16 hr. at 24° C. and 50% relative humidity, then subjected to non-destructive probing. Essentially, the probing test involved vibrating the cantilever beam specimen at an amplitude so low as to preclude damaging the sample structure. The test yielded measurements of resonant frequency and logarithmic decrement as functions of aging time. In all, eight specimens were used. A comparable conventional study of the degradation of mechanical properties would have required 40 times as many specimens. Moreover, the use of the same specimen throughout each aging history considerably reduced the scatter of the data.

Resonant frequency

The frequency at which a reed-like specimen resonates should change as aging gradually alters its dimensions, stiffness, and density, as shown in Part II of this report. The resonant frequency measurement is a kind of quantitative "ring" test, wherein the integrity and stiffness of a material are judged by striking the specimen and listening to the resulting tone. In Fig. 1, p. 144, resonant frequency is plotted, in terms of percentage of initial resonant frequency, as a function

* Reg. U.S. Pat. Off.
† General Engineering Laboratory, General Electric Co.

[1] Vibrin 135. Naugatuck Chemical, Div. U.S. Rubber Co. (formerly designated Vibrin X1047).

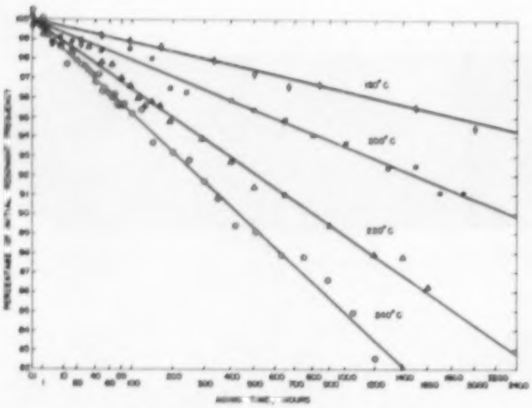

Fig. 1: Percentage change from initial resonant frequency of the glass cloth laminate during heat aging in air

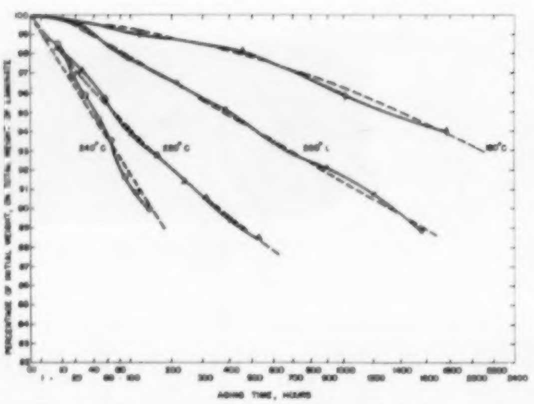

Fig. 2: Percentage weight loss from initial weight of the glass cloth laminate during heat aging in air

of the square root of aging time, for the cases of four aging temperatures. The average initial resonant frequency for the eight specimens of the study was 168.9 cy./sec. ±2 percent. The plots were adjusted within the ±2% spread to direct them to a single starting point, keeping the original slopes constant. In this way the specimen-to-specimen variation was averaged out across all aging temperatures.

The basic trends of the plots in Fig. 1 are linear with the square root of time. One mechanism that yields data of this kind is Fickian diffusion. Such a mechanism is plausible for a solid polymer from which degradation products are escaping, and/or into which oxygen may be diffusing. The assumption that Fickian diffusion may be the rate-controlling process is also supported by the tendency of the weight loss plots for the material toward linearity with the square root of time, as shown in Fig. 2, above.

Comparison of Figs. 1 and 2 points up an advantage of resonant frequency measurements over weight loss measurements. While the resonant frequency plots meander, especially at the lower aging temperatures, their basic trends are clearly linear. Their slopes can be computed with good certainty. The weight loss plots, on the other hand, wander so broadly that there is ample reason to question whether their basic trends are linear at all. This is often the case with weight loss measurements on solid polymers. For one reason or another they usually turn out to be unsatisfactory, leading at best to rather dubious estimates of apparent rate constants. The rate constants derivable from the slopes of the resonant frequency plots are much more convincing.

Logarithmic decrement

The logarithmic decrement is a measure of damping capacity. As is shown in Part II of this report (p. 148, ff), it is the natural logarithm of the ratio of the amplitudes of two successive vibrations of constant frequency after the initial stimulus has been removed. A resonant material will sustain a vibration for many cycles. The first-order rate of decrease in vibrational amplitude in such material is small, as is the logarithmic decrement. Conversely, a "dead" material will damp out a "coasting" vibration in only a few cycles, so that in

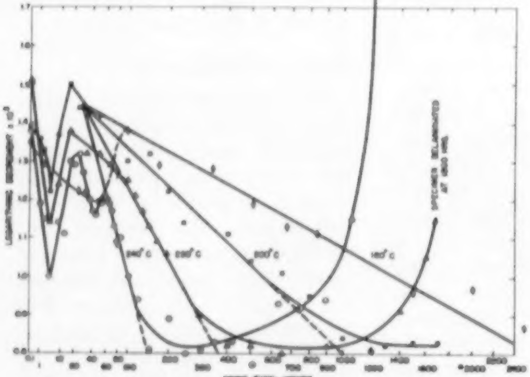

Fig. 3: Change in logarithmic decrement (damping) of the glass cloth laminate during heat aging in air

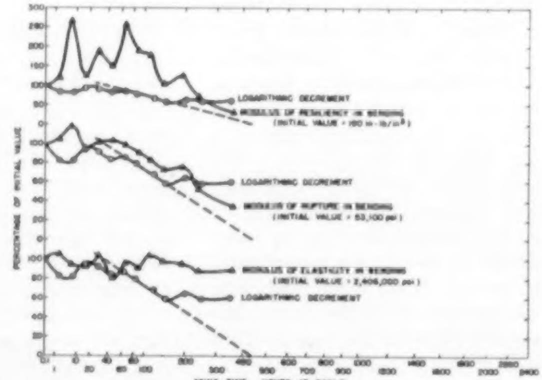

Fig. 4: Damping capacity and flexural properties of the glass cloth laminate versus aging time at 240° C. in air

Cement trailers wear VIBRIN crowns

Far lighter than former riveted aluminum domes, these 8 x 11-foot plastic crowns of NAUGATUCK'S VIBRIN 117, reinforced with glass fibers, have proved easier and less expensive to make. Molded* in one piece by the economical hand-lay-up method, they will not corrode, dent or bend out of shape. Furthermore, they eliminate sweating on the inside of the dome which might cause caking of the powdered cement cargo.

Naugatuck **leads in hand-lay-up molding needs!**

Resins—For large, thermosetting, reinforced polyester moldings—like the above trailer domes, and for truck bodies, auto bodies, boat hulls and swimming pools—Naugatuck provides a number of specially-compounded VIBRIN® liquid resins. When applied to the lay-up of glass mat on the mold, they give excellent wetting, no run-down, rapid gelation and cure at room temperature.

Parting agent—VIBRIN VPA facilitates separation and removal of the cured molding from a large mold. It is easily applied, easily washed off.

Shell coating—Naugatuck chemists have developed several excellent shell coatings which seal in the reinforcing glass fibers and give the molding a smooth, porcelain-like white or colored surface.

Hand-lay-up molding offers the most economical means of producing large prototype parts in small or medium quantities which might be economically prohibitive if stamped of steel. Yet their strength is comparable! For help with *your* particular problem, come to headquarters!

*Molded by Commercial Plastics Co., Santa Ana, Calif., for Trailmobile, Inc.

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such a case the logarithmic decrement is large.

The damping measurements are of especial interest because of the manner in which they vary with aging time. Whereas the resonant frequency measurements simply decline regularly as degradation proceeds, the logarithmic decrement history is characterized by temperature-dependent events, which may be used as guides to the estimation of useful life. Such events are seen in Fig. 3 (p. 144), wherein logarithmic decrement is plotted as a function of the square root of aging time for several aging temperatures. It is seen from Fig. 3 that, owing perhaps to the effects of curing, stress-relieving, stress-build-up, etc., the damping plots pass through minima and maxima initially, then settle down to a regular process, probably embrittlement, which results in consistent loss of damping capacity. The plots then level off for comparatively long periods of time, possibly as the effects of embrittlement are offset by loss of integrity through fissuring and bond failure. Finally, the plots rise, swinging sharply upward as visible loss of integrity and gross delamination occur in the specimen.

In drawing the plots of Fig. 3, the specimen-to-specimen variation was averaged out across the 240 and 220° C. aging temperatures by superimposing the original plots so that their level-off lines coincided with the average level-off value for all four specimens, namely, 0.0082 log decrement. This could not be done for the 200 and 180° C. cases since the corresponding programs had not run long enough to permit defining the level-off. In order to get around this difficulty, the regular process slopes for the 240 and 220° C. plots were extrapolated to their common starting point at 26 hr. and 0.0145 log decrement. Since, presumably, the plots for 200 and 180° C. should also start at the same common point, the original 200 and 180° C. data were accordingly transposed (additively, and on the y ordinate only). The entire averaging operation was within the spread found initially for all eight specimens. The initial log decrement was 0.014 ±7 percent.

Comparison of damping and other mechanical properties

From another aging program, data were available describing the change in mechanical properties of this same type of laminate, aged at 240° C. In Fig. 4, p. 144, logarithmic decrement is compared, at various stages of degradation, with modulus of rupture (ultimate flexural strength), bending modulus (stiffness), and modulus of resiliency in bending, a measure of resilient toughness.[2] The initial minimum in the damping curve appears to be due to increased toughness and strength, rather than increased stiffness in the material. Further curing produces this kind of effect in many plastics. The first peak in the damping curve seems to be associated with the return to initial values of damping, stiffness, toughness, and strength. Build-up of internal stress may account for this loss of the post-curing gain. During the regular decline in the damping curve the material is tending toward increased stiffness and decreased toughness and ultimate strength, all convincing indications of embrittlement. During the initial portion of the level-off in the damping curve, the material becomes stronger and less stiff, perhaps as the effects of resin-embrittlement are offset by catastrophic stress-relieving. Thereafter, the material appears to become progressively weaker without much change in stiffness until the point at which gross self-delamination begins is reached.

Table I: Reciprocal diffusion coefficients for Vibrin 135 glass-cloth laminate

Aging temperature ° C.	D^{-1} *days*
180	73.5
200	23.4
220	8.01
240	4.40

[2] All measurements were made at 24° C. and 50% relative humidity at a rate of strain of 0.05 in./minute.

In at least a qualitative way, then, the damping curve reflects the degradation of mechanical properties. Perhaps as experience is gained with other materials, it may, in time, be possible to determine the useful life of a new material by conducting only initial and final destructive mechanical tests. It seems quite likely that the time at which final tests should be run can be predicted by studying the results of the non-destructive damping tests.

Effect of aging temperature and expected life

It will be recalled that the resonant frequency plots of Fig. 1 afford convincing estimates of rate constants. The slopes of the plots can be considered to be the square roots of the corresponding apparent diffusion coefficients. In deriving life-temperature characteristics, it is convenient, further, to convert the squared slopes of Fig. 1 to reciprocals, expressed in days, as listed in Table I, left.

In Fig. 5, p. 148, it is seen that the Arrhenius plot of the data in Table I is quite linear for a solid material. The slope of the plot yields an apparent activation energy of 22.6 kcal. for the degradation. Some polymer chemists believe that this is not excessively high for diffusion in a hard, solid plastic.

As was noted earlier, the events in the damping plots of Fig. 3 may be used as guide-posts in predicting useful life as a function of operating temperature. For example, comparison of the damping and flexural strength curves in Fig. 4 shows that the level-off in the damping curve occurred at the time when the flexural strength of the laminate had declined to about 75% of the initial value, in other words, after approximately 140 hr. at 240° C. Taking the average value of logarithmic decrement at level-off to be 0.0082 and extrapolating the linear portions of the damping curves to this level, one obtains estimates of aging time ranging to 75% of initial flexural strength at all four aging temperatures. These estimates, con-

verted to days and plotted in Fig. 5, yield a reasonably linear Arrhenius plot, whose slope is in good agreement with that found for reciprocal apparent diffusion coefficients.

It would also appear that, by extrapolating the linear portions of the damping curves to zero logarithmic decrement, one obtains an estimate of virtually complete degradation time. This extrapolation, shown for the 240° C. case in Fig. 4, indicates that the mechanical strength of the laminate will have declined virtually to zero after about 440 hr. at 240° C. This seems likely, since the specimens tested at 360 hr. underwent failure by gross delamination.

The remaining plots in Fig. 5 were drawn through single experimental points to the slope of the four-point plots. Time to ½ strength was taken from the flexural strength plot in Fig. 4, viz., about 240 hours. Time to delamination in test was taken as 360 hr., as noted above. Time to gross delamination (when the sample can no longer withstand even gentle handling) was based on the earliest case observed, namely, after 1800 hr. at 220° C. Judging from the damping curve at 240° C., the average time to gross delamination at 220° C. may be in the neighborhood of 3100 hours. However, since the gross delamination stage of weakness is approached either asymptotically or abruptly, depending on whether almost negligible accidents occur, it seems wise to accept the minimum value. It is seen by extrapolation in Fig. 5 that the 20-year life, continuous operating temperature limit for Vibrin 135-glass cloth laminate is of the order of 120 to 130° C.

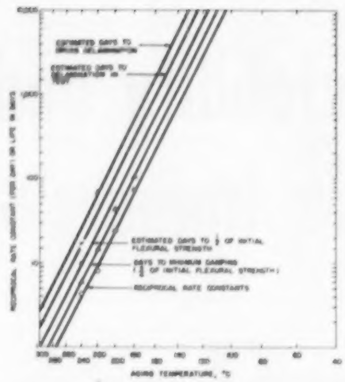


Fig. 5: Life of the glass cloth laminate plotted against aging temperature in air

Part II: Method of test

By C. S. Duckwald‡

Part I of this article introduced the quantities "logarithmic decrement" and "resonant frequency" and discussed how the changes in these quantities can be correlated with changes in the mechanical integrity of plastic material. This part of the article includes a short discussion of the quantities measured and presents a method which has been developed for their measurement.

Mechanical properties measured

In general, Part I of the article discussed the time aging effect in relation to the changes in two mechanical properties of a plastic material.

The two mechanical properties of the plastic that were studied are as follows: 1) the first mode mechanical vibration resonant frequency of the specimen when supported as a cantilever beam, and 2) the logarithmic decrement or vibration damping for the specimen vibrating in this mode.

The specimen is roughly in the form of a ⅛ in. thick by ¼ in. wide by 4 in. long cantilever beam that is vibrated normal to its ¼ in. surface. The resonant frequency of this specimen is the natural vibration frequency that would be obtained if the specimen under test were deflected from its "at rest" position and then released.

The vibration damping for the specimen vibrating in this mode is that property of the specimen material that causes the vibration amplitude of the freely vibrating plastic specimen under test to slowly decay and come to rest.

The resonant frequency of the specimen can be expressed by the following equation:

$$f = 0.16 \frac{d}{l^2} \sqrt{\frac{Eg}{\rho}}$$

where f is the resonant frequency in cycles/sec., d is the thickness of the specimen in in., l is the effective length of the overhung part of the specimen in in. (effective length is used instead of the total overhung length, as the final specimen included rather generous fillets at the base), E is Young's modulus of the material in p.s.i., g is acceleration due to gravity in in./sec.[2], and ρ is weight per unit volume in lb./cubic inch.

By studying the above relations, one can see how changes in the dimensions and properties of the material will change the resonant frequency of the specimen. For example, if the temperature-time part of the aging test gives the plastic a greater cure, it is possible for Young's modulus to change, thus changing the resonant frequency. If the time and temperature cause the specimen to shrink or decrease in thickness and increase in density, then, by the above relation, the resonant frequency will decrease.

The logarithmic decrement of this specimen is affected by such changes in the material as fissuring of the surface, delamination of laminated specimens, or loss of bond of fibrous specimens. It is found that very small changes in these characteristics of the specimen can cause measurable changes in the logarithmic decrement long before these changes in the specimen are susceptible to observation by eye.

Measuring procedure

General technique. The resonant frequency of the specimen is measured by driving the specimen

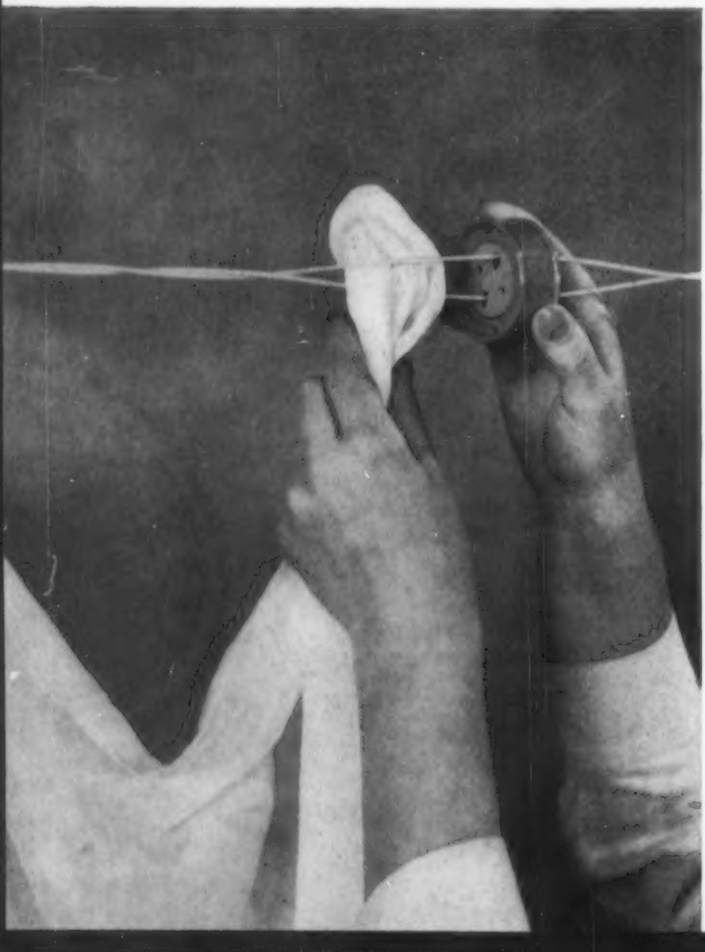
(*To page* 153)

‡General Engineering Laboratory, General Electric Co.

THIS FLYING SCALE MODEL of a Navy "Skyray" jet fighter is made from extruded sheets of BAKELITE Brand High-Impact Styrene TGD-5001, vacuum-formed to reproduce authentic details down to the rivet heads.

Design and material complement each other. Leading edges of wings and nose are constructed with extra strength to absorb the impact if the plane dives into the ground. The BAKELITE High-Impact Styrene combines fabricating ease with toughness, durability, and excellent finish. The model's color matches that of its prototype. Flexibility and light weight are further advantages – the plane is lighter than one of balsa wood.

Model airplane produced by **Gold Brand Products Co.,** Closter, N. J., from sheet supplied by **Nixon Nitration Works,** Nixon, N. J.



THIS NEW CLOTHESLINE is made of twin strands of steel wire covered with extruded BAKELITE Brand Elastomeric Vinyl Plastic. Clothes are attached or released when strands are separated by the disk-shaped spreader. The plastic covering stays resilient for a safe, sure grip. It protects clothes from rust, won't flake off. Besides resisting moisture, mould, and wear, its smooth white surface is readily wiped clean.

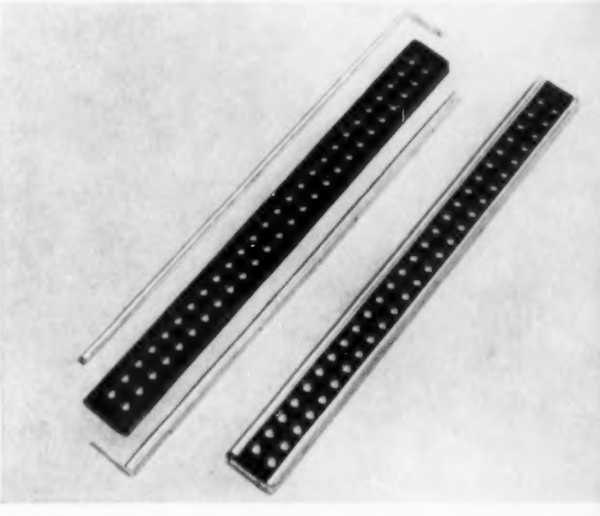
Wire and cable covering, colored belting, welting, garden hose, and contour extrusions are among the variety of applications for BAKELITE Vinyl Elastomeric Plastics. Formulations can be varied to provide flexibility or semi-rigidity as desired. They can be fabricated with a high-gloss or soft matte finish. Transparent, translucent, or opaque effects are also possible, in a wide range of colors.

"Pin-O-Matic" Clothesline manufactured by **Dennan Mfg. Co.,** Providence, R. I.

Polyethylene-jacketed steel tape
produced by the **Garrison Company,**
South Plainfield N. J.

STEEL TAPE WITH A JACKET of extruded BAKELITE Brand Polyethylene combines the tensile strength of steel with the non-abrading surface and corrosion resistance of plastic. Its ends can be heat-sealed for complete protection against corrosion. High dielectric strength is an added feature of the polyethylene covering. Stripping off sections of the jacket permits the tape to be riveted, bolted, or spot-welded. Suggested uses include outdoor furniture upholstery webbing, hangers for cable harnesses, and packaging applications, such as straps and carrying handles.

BAKELITE Polyethylene is excellent for plastic-over-metal extrusions. For example, it has already given long and successful service on wire and cable as jacketing and insulation. It retains its flexibility for long periods —the black compound resists weathering and aging. Polyethylene also provides excellent chemical resistance and a range of eye-catching colors that further enlarge the variety of its applications.



Jack blocks for **Lenkurt Electric Sales Co.,** San Carlos, Calif., molded by **Remler Co., Ltd.,** San Francisco, Calif.

THESE TELEPHONE JACK BLOCKS, transfer molded of BAKELITE Brand Phenolic BMG-5000, represent an unusual accomplishment in precision molding. Each contains 104 molded-in holes and eight inserts. Uniform shrinkage keeps hole diameters to a tolerance of ± .004 inches. Excellent machineability facilitates drilling and counter-sinking eight mounting screw holes in one operation. Freedom from warpage ensures that jack blocks are straight and true and can be mounted in groups without difficulty. The gloss and jet black color of BMG-5000 improve the board's appearance and greatly reduce finishing costs.

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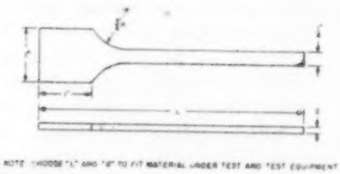


Fig. 6: Shape and size of specimen used in test

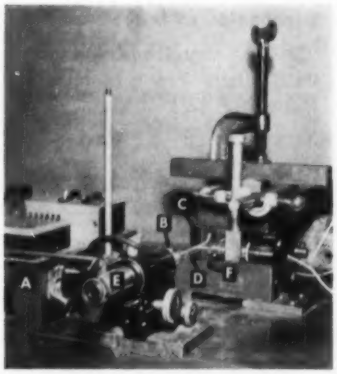


Fig. 7: Specimen assembly for non-destructive mechanical life test: A — level recorder; B — drive coil; C — specimen clamp; D — test specimen; E — vibration amplitude microscope; and F — capacitance-type vibration pick-up

men at a constant vibration amplitude and at a driving frequency that is adjusted to give maximum amplitude when a constant vibration force is applied to the specimen. The frequency of the vibration driving force that results in maximum amplitude is called the resonant frequency.

With the specimen vibrating at its resonant frequency and at a constant amplitude, an amplitude recorder is started and then the vibration driving force is removed. The recorder then records the resulting decreasing or decaying vibration motion. It is from this record that the logarithmic decrement is calculated. As stated in Part I, above, the logarithmic decrement is a measure of damping capacity.

Specimen. The specimen shape found most convenient and effective for this type of testing is shown in Fig. 6, above. The specimen is clamped to a rigid foundation by heavy steel jaws that grip the 1- by 1-in. section of the specimen. With the specimen clamped in this manner, the ¾-in. fillet and the straight section of the specimen form the cantilever beam that is vibrated normal to its ¼-in. surface. An actual specimen as mounted in the test equipment used in these experiments is shown in the photographs in Figs. 7 and 8. The various components that comprise the test set-up are identified in the pictures by letters.

Vibration driving system. The vibration driving force, which establishes the steady-state vibration amplitude of the specimen mentioned above, is obtained by the action of an electromagnetic drive coil on a piece of magnetic material clipped to the free end of the specimen. The position of the drive coil is shown in the photograph in Fig. 8, and is also indicated in the block diagram of Fig. 9. The energy for the drive coil is obtained from the power amplifier and oscillator as indicated in Fig. 9.

Vibration amplitude recording system. A signal proportional to the vibration amplitude of the specimen is obtained from the capacitance-type vibration pick-up indicated in the block diagram, Fig. 9, right, and shown in the photograph of Fig. 7. The voltage output from this pickup is first amplified and then recorded on the level recorder as illustrated in the block diagram. As mentioned before, in this type of instrumentation the logarithmic decrement is not measured directly but is calculated from the vibration decay curve. A very convenient method for recording this decay curve is by the use of a potentiometer-type level recorder, which provides a record of the amplitude of vibration on a decibel (db) scale as a function of time. This type of recording is recommended, as much less record handling is needed and the calculation of the logarithmic decrement is somewhat simpler than encountered with systems using photographic records or a linear amplitude scale. A typical record is shown in Fig. 10, p. 154.

Frequency measuring system. Since the changes in the resonant

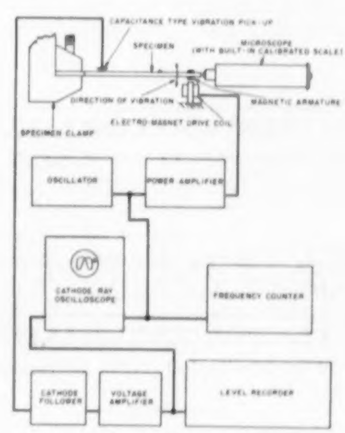


Fig. 9: Block diagram of apparatus in Fig. 8

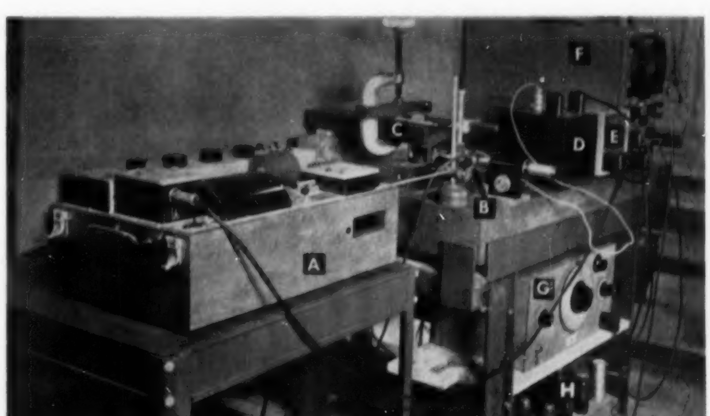


Fig. 8: Apparatus set-up used in non-destructive life test. A — level recorder; B — vibration drive coil; C — test specimen positioned in clamp; D — cathode follower; E — voltage amplifier; F — cathode-ray oscilloscope; G — oscillator; and H — power amplifier

frequency of this specimen is one of the mechanical properties followed in the aging test, it is necessary to have a stable and accurate method for measuring this frequency. The most practical unit for this measurement is a frequency counter with a built-in time base reference that allows a frequency count for 10 seconds. With this time-base reference the frequency readings can be obtained that are accurate to within 0.1 cycle per second.

The cathode-ray oscilloscope shown by the block diagram in Fig. 9 is used to assist in accurately setting the oscillator frequency so that it corresponds to the resonant frequency of the specimen.

The oscilloscope has its horizontal axis connected to the oscillator driving the specimen and its vertical axis connected to the vibration pickup amplifier output. When the oscillator frequency is swept through the specimen resonant frequency, the pattern on the cathode-ray oscilloscope will reach a peak in vertical amplitude and display a rapid phase shift. Both of these phenomena are used to indicate the presence of the resonant frequency and to provide a means of accurately setting the oscillator on this frequency.

Calculation of logarithmic decrement

As mentioned above, the logarithmic decrement is not measured directly, but is calculated from the vibration decay curve. Since it is recommended that the decay curve be recorded on a level recorder using a db scale, the derivation of the expression for calculating the logarithmic decrement on this scale is given below.

The logarithmic decrement is defined as the natural logarithm of the ratio of any two successive amplitudes (A_{n+1}/A_n) of a damped, freely vibrating system. Thus:

$$\delta = \ln\left(\frac{A_{n+1}}{A_n}\right)$$

In the method proposed, the amplitude ratio is plotted on a db scale; thus:

$$(db)_1 = 20 \log\left(\frac{A_{n+1}}{A_n}\right)$$

$$= 20 (\log e) \ln\left(\frac{A_{n+1}}{A_n}\right) = 20 (\log e)$$

$$\delta = \frac{(db)_1}{20 \log e} = 0.115\,(db)_1$$

This says that the logarithmic decrement equals 0.115 times the change in decibel level between two successive amplitudes.

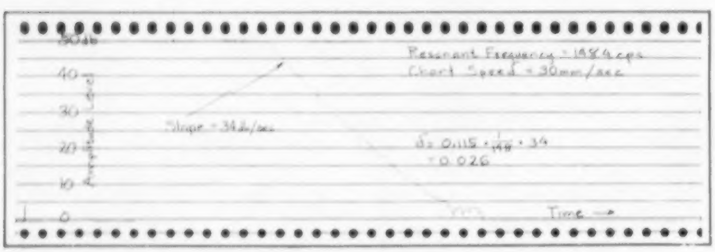


Fig. 10: Typical plot of a vibration decay curve

The level recorder plots the db amplitude level as a function of time. The slope of this curve at any time is $\Delta db/\Delta t$. The time T per cycle equals $1/f$ or the reciprocal of the vibration frequency in cycles per second. Thus, the decibels between two successive amplitudes or cycles can be expressed as:

$(db)_1$ = (time per cycle) times (slope of decay curve)

$$= T \times \frac{\Delta db}{\Delta t} = \frac{1}{f}\frac{\Delta db}{\Delta t}$$

Thus:

$$\delta = 0.115 \frac{1}{f}\frac{\Delta db}{\Delta t}$$

In the above, A_n is amplitude of nth cycle, A_{n+1} is amplitude of the (n+1) cycle, $(db)_1$ is decibel change between successive cycles, ln is logarithm to base e, log is logarithm to base 10, δ is logarithmic decrement, Δdb is incremental change in decibel level for a corresponding increment in time, Δt is incremental change in time, and f is resonant frequency of the freely vibrating system in cycles per second.

Discussion of test variables

It was found early in the investigations for this measuring technique that if the vibration strain was much more than 250 microinch./in., the plastic material undergoing test experienced an irrecoverable change both in resonant frequency and logarithmic decrement. It was also found that the logarithmic decrement was not independent of the amplitude of vibration. Thus, it was always necessary to measure the logarithmic decrement at the same amplitude for each age-point test.

Since the test involves studying only the changes in the two mechanical characteristics, the absolute values of these two characteristics are not too important. Thus, it is not essential that all specimens should be of exactly the same size, or have the same resonant frequency. The usual policy is to choose the specimen dimensions *L* and *d* in Fig. 6 to best suit the type of material under test and the range of frequencies and amplitudes that can be best handled by the recording and other measuring equipment available. For the particular material used in the development of this test, L = 5 in. and d = 0.125 inch.

In this non-destructive test for changes in the mechanical properties of a material, one specimen is used for each complete life test curve. Thus, since all age points in a life test curve were taken on the same specimen (conventional life tests usually require a new specimen for each age point), the total number of specimens required was approximately 1/40 of that for a conventional test. Besides reducing the total number of specimens required, a more important advantage of this type test is the elimination of the scatter in the data due to variations between specimens.

The mechanics of
Plastics reinforcement in tension

*By J. Ogden Outwater, Jr.**

A mathematical relationship is obtained for the tensile modulus of elasticity of unidirectionally reinforced plastics both for the case of continuous fibers and for the case where short fibers are used. By a comparison of these values it is possible to show the influence of various properties of the resin and fibers on the final properties of the laminate. In particular, it is shown that the adhesion between the resin and the fibers only influences the properties of the laminate before it is preloaded.

While the use of fiber-reinforced plastics as a light and strong material of construction has increased enormously in recent years, the mechanism by which it accomplishes the feat of combining the useful properties of both the fiber and the plastic has received little attention. One reason for this is the inherent difficulty of studying the structure and interfaces between the resin and the fiber on other than a macroscopic scale. In this paper we shall advance a mathematical theory consistent with the mechanics of an actual specimen of reinforced plastics and show the significance of the various properties of its constituents on the final property of the material. By comparing the mathematical expression obtained for a key property, the modulus of elasticity, of a specimen made with continuous fibers to that obtained for a specimen with short fibers, we can hope to explain the significance of the various individual properties and explain some of the anomalies that are observed in the material.

To do this we must first see how the fibers are located within an actual specimen of reinforced plastic. Figure 1 shows a cross-section of a specimen reinforced by continuous strands of glass fiber. It is polished and etched by fire to show the distribution of the fibers. We can see here that a laminate consists of two different types of region: 1) where the fibers are bunched together and are uniformly and closely spaced, and 2) where there are resin-rich areas separating these bunches. This characteristic is much more marked in the case of glass cloth-reinforced resin as the transverse fibers tend to force the longitudinal ones into tight groups. Both these types of area comprise the final material and it is by understanding the mechanism of each and their interaction that we can get a picture of the laminate as a whole.

Continuous strand material

In order to simplify our analysis we shall first consider the case of a resin reinforced by uniform, continuous, and unidirectional strands of circular cross-section. In this case the ratio of the weight of glass to that of the whole material, *R*, is given by:

$$R = \frac{A_G \rho_G}{A_G \rho_G + A_R \rho_R} \qquad \text{Eq. 1}$$

where A_G and A_R are the areas of fiber and resin in a unit cross-section area of the plastic and ρ_G and ρ_R are densities of fiber and resin of which the plastic is comprised.

By substituting the reasonable values of $\rho_G = 2.6$ and $\rho_R = 1.15$, which are representative of glass and resin in equation 1, we get:

$$\frac{1}{R} = 1 + 0.442 \frac{A_R}{A_G} \qquad \text{Eq. 2}$$

If the strain of the laminate under a uniform stress of *W* per unit area is e_C, then, as the extension of both the fiber and the resin is the same, the portion of the load carried by the resin will be $e_C \cdot E_R \cdot A_R$ and that carried by the fiber will be $e_C \cdot E_G \cdot A_G$, or the ratio of the load carried by the resin to that carried by the glass will be $E_R \cdot A_R / E_G \cdot A_G$, where E_G and E_R are the elastic moduli of the fiber and the resin. When we substitute for A_R/A_G from equation 2 in this ratio and use the representative values of $E_G = 10 \times 10^6$ p.s.i. and $E_R = 5 \times 10^5$ p.s.i., which are reasonable for glass and polyester, we get the

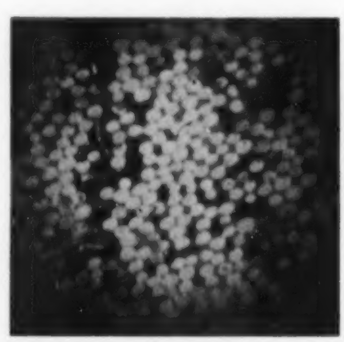


Fig. 1: Photomicrograph of a section of plastic reinforced by continuous fibers, polished and fire-etched

This article is based on a paper presented at the annual meeting of the Reinforced Plastics Div., Society of the Plastics Industry, Feb. 8, 1956.

*Massachusetts Institute of Technology, Cambridge, Massachusetts.

ratio of the load borne by the resin to that by the fiber to be

$$0.113\left(\frac{1}{R}-1\right)$$

The majority of the commercially made unidirectionally reinforced plastics are made with a value of R well above 60% and in this case the ratio of load carried by the resin to that carried by the glass is below 8 percent. As this value is quite low, we will assume in the remainder of this analysis that all the load is carried by the fiber, appreciating the approximation made and the fact that it is unjustified on comparatively resin-rich laminates.

If we use this approximation, we can readily obtain a value for the modulus of elasticity of the laminate in terms of R and E_G. If the glass carries all the load, then the strain under a stress W is $W/E_G \cdot A_G$, but this strain is also $W/E_C(A_G + A_R)$, so:

$$E_C = E_G \frac{A_G}{A_G + A_R} \qquad \text{Eq. 3}$$

or substituting for A_G and A_R from equation 2, we get the following expression:

$$E_C = \frac{E_G}{\frac{2.26}{R} - 1.26} \qquad \text{Eq. 4}$$

It should be noticed that this equation is valid regardless of the distribution of the reinforcing fibers within the laminate so long as they are continuous, parallel, and uniform.

The fact that we have assumed that all the load is carried by the glass does not imply that the resin serves no purpose. The resin performs the vital service of transmitting the load to the fiber and distributing it so that each strand will take its share of the load.

This function is minimized in continuous strand material but becomes of increasingly greater importance as the fibers are shortened. In order to show this effect we shall compare the modulus of elasticity of a laminate prepared with long parallel continuous strands to that made of the same strands with the same density, spacing, and other properties but each of length l. The ends of the short fibers will be assumed to be randomly spaced along the length of the specimen. From the difference in the modulus of elasticity of these specimens we shall see the effect of the various properties of the components on the properties of the laminate.

Influence of resin on a reinforcing strand

We have seen from Fig. 1 that by far the greater portion of fibers are bunched quite closely together and, if we are to determine the influence of the resin on the fibers, it would be logical to examine critically the mechanism of interaction in these crowded areas.

When the plastic is first made, the fibers are impregnated or soaked in liquid resin, which then polymerizes or condenses around the fibers to form a rigid solid. During this process not only does the resin stick to the glass but it also shrinks on curing. We shall examine the effect of the sticking below, but first let us examine the influence of the shrinkage on the individual fibers.

If we consider the nature of the fibers where they are bunched together so that the distance between them is a small uniform distance t, then it is apparent that the resin will behave as a bundle of thin walled tubes of internal diameter D, the diameter of the fiber, and of wall thickness ½ t. As under conditions of strain the longitudinal and radial strains are constant, there will be no shear between the tubes.

If the shrinkage on curing is s, then the tube of resin around each fiber will tend to shrink and, if the fiber were not present, it would shrink diametrically a distance $D \cdot s$. This shrinkage is resisted by the fiber and, therefore, a pressure will be built up between the fiber and the resin sheath enclosing it. If F is the yield point of the resin, then the maximum value of s would be given by:

$$s \cdot E_R = F \qquad \text{Eq. 5}$$

If we substitute values of $E_R = 5 \times 10^5$ p.s.i. and $F = 9000$ p.s.i. in equation 5, we find that the shrinkage permissible to bring the material to its yield point is 0.018.

Now as the shrinkage in a piece of glass fiber-reinforced polyester is very slight and is sometimes referred to as zero, we might be inclined to believe s is too small to matter, but the shrinkage of the resin is actually only reflected in the over-all shrinkage of a piece of laminate in the ratio t/D, as the shrinkage can only apply to the resin between the fibers to shrink these fibers closer together and does not apply to the fibers themselves which comprise the bulk of the material. For this reason we can expect only a small fraction of the shrinkage of the resin to be reflected in the shrinkage of the fibrous glass-polyester laminate as a whole.

The value of shrinkage of polyester is about 0.02 in./in. (1)[1] and we can therefore expect the resin to be at its yield point around the reinforcing fiber. If we now assume this to be the case, we can readily determine the pressure of the resin on the glass as that exerted by a thin-walled tube of internal diameter D, wall thickness $t/2$, and circumferential stress F when the pressure p will be $F \cdot t/D$.

Stability of end of fiber before preloading

Consider the case of a fiber of diameter D embedded in a plastic with adhesion σ per unit area, coefficient of friction between the resin and fiber μ, pressure p between the resin and the fiber, and elongation of the plastic e_c. If there is to be no movement of the end of the fiber, then the tension in the fiber will be uniform along its length and such as to elongate it e_c. The tension will therefore be $E_G \cdot e_c$.

If we now consider the equilibrium of the flat end of the fiber, the tension will have to be supplied by the adhesion alone when $\sigma = E_G \cdot e_c$. This sets an upper limit on the strain before the end is made to slide relative to the matrix and, as there is no relative motion between the fibers and the resin, the modulus of the

[1]Numbers in parentheses link to references at end of article, p. 248.

composite material from equation 3 will be

$$E_0 \frac{A_0}{A_0 + A_n}$$

and the load W_0 before the ends tear out will be given by:

$$\frac{\sigma}{E_n} = e_c = \frac{W_0}{E_0 \frac{A_0}{A_0 + A_n}}$$

So:

$$W_0 = \frac{A_0 + A_n}{A_0} \sigma \qquad \text{Eq. 6}$$

This value of W_0, then, is the load on the material when the ends of the fibers will be pulled out, break their adhesive bond, and move relative to the resin matrix. The value of W_0 will be about 2½ times that of the adhesive strength of the resin and this, of course, will be well below the ultimate load capacity of the laminate. When the load is removed, then the fiber will return to its original position but, as the adhesive bond has been broken, the modulus and the bond will never again be restored to their original value and for all practical purposes may be assumed to be zero. This change takes place on preloading, and, as the most usual condition will be that of the laminate after preload when the adhesion at the end is zero, this is the case that we must examine in greater detail.

Stability of end of fiber in tension after preloading

After preloading we can assume that the adhesion on the end of the fiber is zero. Similarly, if we extend the reasoning by which we arrived at this conclusion for the end of the fiber, to the stability of any section near the end where the effects of adhesion might apply, we can see that as adhesion can only be valid where there is no relative motion at all, it can have negligible influence on holding the end of the fiber in position. This is only the case if the resin around the fiber does not deflect in shear and, as the resin sheath is very thin compared to the necessary displacement of the fiber end, this will be the case. This is perhaps similar to what may be observed when we stretch a piece of rubber which has a rigid glue spot on it. A shear line travels in from the edge of the spot to its center detaching the glue spot without effectively altering the strain pattern on the rubber sheet. Here we have a similar effect with the shear line travelling along the fiber from its end, detaching the fiber from the resin without substantially affecting the strain pattern in the laminate. This occurs only when the initial adhesion of the end is overcome.

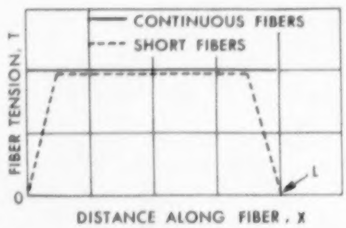


Fig. 2: Relationship of tension in fiber, T, and distance from end of fiber, x, for continuous and short fiber reinforcements

As adhesion is therefore of slight importance in maintaining the position of the end of the fiber, the force that will control the end of the fiber will be the friction resulting from the pressure P of the resin on the fiber. If we consider the stability of a section of the fiber at a distance x from its end where the tension in the fiber is T then:

$$dT \cdot \frac{\pi D^2}{4} = p \cdot \pi \cdot D \cdot \mu \cdot dx$$

or as $p = F \cdot t/D$:

$$dT = \frac{4F \cdot t \cdot \mu \cdot dx}{D^2}$$

or, as the tension at the end is zero:

$$T = 4\mu \frac{F \cdot t}{D^2} \cdot x \qquad \text{Eq. 7}$$

The point where the strain in the fiber is the same as that in the resin will therefore be at a point which is removed from its end by

$$\frac{e_c \cdot E_0 \cdot D^2}{4 F \cdot t \cdot \mu}$$

Using these relationships we can plot the stress in a fiber against its length for the case of a continuous fiber and for a short fiber in tension as in Fig. 2 and by using this T, x relationship, we can relate the elastic moduli of a composite material under these restraints.

If we assume that all the load is taken by the fibers, then the moduli of the specimens can be related by the area under the T, x curves, or:

$$\frac{E_{cs}}{E_c} = \frac{\left(\int_0^l T dx\right)_s}{\int_0^l T dx}$$

where l is the length of a short fiber and E_{cs} the elastic modulus of the material made of short fibers. From Fig. 2:

$$\frac{E_{cs}}{E_c} = \frac{Tl - \frac{e_{cs} \cdot E_0 \cdot D^2 \cdot T}{4F \cdot t \cdot \mu}}{T\,l}$$

$$E_{cs} = E_c - \frac{e_{cs} \cdot E_0 \cdot E_c \cdot D^2}{4F \cdot t \cdot \mu \cdot l}$$

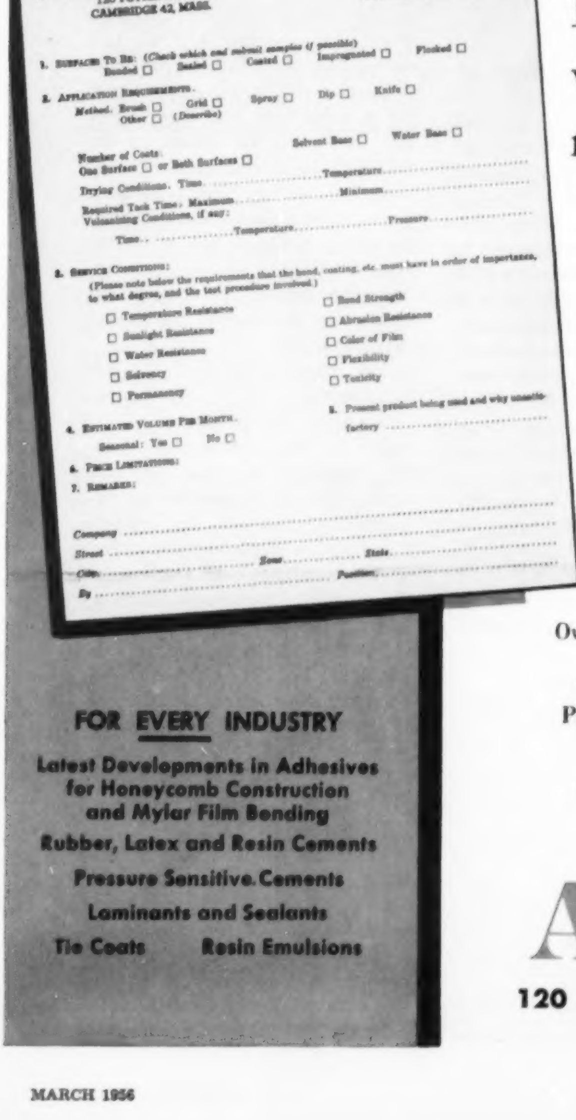
or, as $W = E_c \cdot e_{cs}$:

$$E_{cs} = E_c - \frac{1}{4\mu} \cdot W \cdot \frac{1}{F} \cdot \frac{D}{l} \cdot \frac{D}{t} \cdot E_0 \qquad \text{Eq. 8}$$

We must be careful to note the approximations that we have made in this case, the most significant being: 1) that the shortened fibers are randomly spaced along the length of an equivalent filament; 2) that the glass supports all the load; 3) that the resin does not re-adhere once the bond has been significantly broken; 4) that the resin shrinks on setting as ordinary resins do; 5) that the shear deformation in the resin is negligible; 6) that Hooke's law, isotropy, etc, may be assumed throughout; and 7) that the reinforcing glass fibers are distributed as in a usual laminate.

Effect of preloading

The results of equations 6 and 8 are of great significance as the effects of preloading can be explained by them; they also show the dependence of an important property of the material, the elastic modulus, on the various properties of the components that make it up, using approximations



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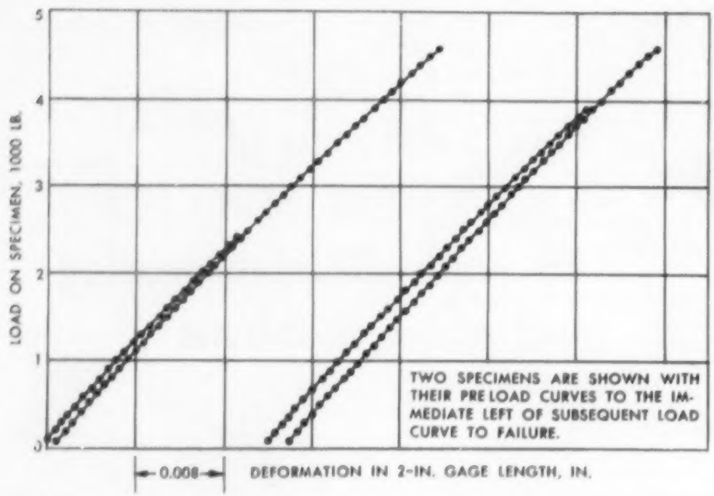

Fig. 3: Typical load-deformation curve of 181 glass-fabric laminate. Each specimen was loaded once to maximum preload, the load was reduced to the initial load, and the specimen was then loaded to failure (see reference 2). The curve for the preload is to the immediate left of the load curve and is measured on the same scale

that are valid for practical materials.

If we examine the preload and stress-strain curve of a typical material as in Fig. 3 (2), we can readily see what preloading does to the stress-strain relation in the material.

On first loading the material, there is a straight-line stress-strain relationship up to about 750 lb. when E_c is constant. At this value there is a discontinuity; the modulus of elasticity is reduced and the curve continues upwards. When the load is taken off and the material is reloaded, the stress-strain relationship no longer shows this discontinuity and the initial value of E_c is reduced.

This effect can be readily explained by the above theory in that the discontinuity is caused by the ends of the fibers pulling out from their resin matrix; the 750 lb. in Fig. 3 corresponds to the value of W_0 in equation 5. It should be noted that this value is independent of the length, spacing, or size of the fibers and depends solely on their modulus and *R*. This value of W_0 is well below the ultimate strength of the material and, in this case, is about one-sixth of the final value. Once the ends have moved the modulus will be lowered according to the relationship in equation 8 and the initial value will never again be equalled.

Table I: Strip loads per inch of width of glass fabric laminates[a]

Condition of glass cloth	*Polyester 1*	*Polyester 2*	*Polyester 3*	*Polyester 1 plus 5% titanium dioxide*	*Epoxide resin*
	lb./in.	*lb./in.*	*lb./in.*	*lb./in.*	*lb./in.*
Loom state					
Unaged	3.2	1.2	1.7	2.3	5.0
Aged in 70° C. water for 1 wk.	3.6	2.1	2.1	3.2	4.0
Volan treated					
Unaged	0.4	1.2	1.6	0.23	5.5
Aged in 70° C. water for 1 wk.	0.9	1.1	1.8	0.73	Tear

[a]Tests made with a Dillon tensile machine with a rate of jaw separation of 2 in./min. and full scale range of 10 pounds.

Effect of loading after preload

In this case the controlling equation is equation 8 and we will examine this in detail. This equation shows that we can expect a lowering of the modulus of a laminate made of short fibers compared to that of a laminate made of continuous fibers according to certain properties of the material comprising the laminate. As the properties of a laminate made with continuous fibers were independent of the properties of this resin, we may conclude that this equation is an accurate indication of the influence of the various properties of the component materials.

Perhaps the most striking point is the absence of an adhesion term in the relationship. We saw above that the effects of adhesion after preload would be nullified by a shear line travelling down the fiber and the strain in the resin would be transmitted to the fiber by friction. The $1/4\mu$ term in equation 8 shows the influence of friction: the larger μ is, the less the falling off in modulus; and, conversely, the smaller the value of μ, the greater the falling off in modulus.

The lowering of modulus due to dampness (1, 3) may be explained by the reduction of the value of the coefficient of friction between the glass and the resin. Also, it is possible to explain the value of the surface treatment of glass fibers in terms of the coefficient of friction. A fiber surface treatment, such as Volan, greatly improves the properties of the composite material (3) but does not noticeably change the adhesion characteristics of the resin-glass combination. In Table I (4), left, are presented some figures concerning differences in treated and untreated glass cloth.

This table gives us an approximate idea of the adhesive characteristics of various resin-glass combinations; it can readily be seen that there is no marked change in this characteristic in the case of Volan-treated cloth;

(*To page* 245)

Heat-resistant methylstyrene polymers

*By J. A. Melchore**

Methylstyrene made by a new monomer synthesis can be used to produce molding compounds whose improved heat resistance should not only upgrade the quality of moldings in many existing applications but should also open up new fields of application. Polymer from this methylstyrene has improved heat resistance and, in addition, has all the desirable properties of polystyrene. Moldings of polymethylstyrene may be repeatedly heated at 100° C. with shrinkage less than 0.31 percent.

By copolymerizing methylstyrene with 30% acrylonitrile, improvement was noted in polymer toughness and heat, craze, abrasion, and chemical resistances. The rate of copolymerization of methylstyrene and acrylonitrile is faster than styrene and acrylonitrile. The heat resistance of the methylstyrene-acrylonitrile copolymer is considerably greater than the corresponding styrene copolymer.

The broad utility of methylstyrene may be realized in other fields, such as polyester resins, surface coatings, rubbers, textiles, and paper treatments.

The principal shortcomings of polystyrene have been brittleness, lack of heat resistance, and crazing. Several types of modified polystyrenes have been offered commercially. Impact resistance has been obtained by modification with a rubbery constituent. As to heat resistance, while some improvement has been obtained either by reducing the residual content of unreacted monomer in the polymer or by copolymerization, the improvement in heat resistance has not been sufficiently great to be of much value. Where good heat resistance has been obtained, it usually has been at the expense of color, clarity, and cost. A crystalline polystyrene having a high softening point has recently been produced by Natta (1, 2)[1] but very little has been disclosed concerning other physical properties of the compound.

An alternate approach to improved heat resistance is through substituted styrenes. Marvel and his workers reported on the investigation of many substituted styrenes (3-6). Frank and his colleagues worked with alkoxy and aryloxystyrenes (7). Fluorinated styrene was prepared by Renoll (8), while fluoro-chlorostyrene was synthesized by Weinmayr (9). The dichlorostyrenes were examined by Michalek and Clark (10). In 1945 Sturroch and Lawe developed a process for preparing substituted styrenes by the catalytic cracking of diarylethanes (11). This process for producing substituted styrenes has since been investigated extensively by our company. This development of substituted styrenes, particularly methylstyrene, has been inspired not only by an improved polymer but also by a favorable process and readily available and inexpensive raw materials.

The synthesis of monomethylstyrene has been described previously in detail by Dixon and Saunders (12). The present discussion is primarily confined to the properties of methylstyrene polymers. However, before discussing the methylstyrene polymers, it might be desirable to summarize very briefly the synthesis of methylstyrene mono-

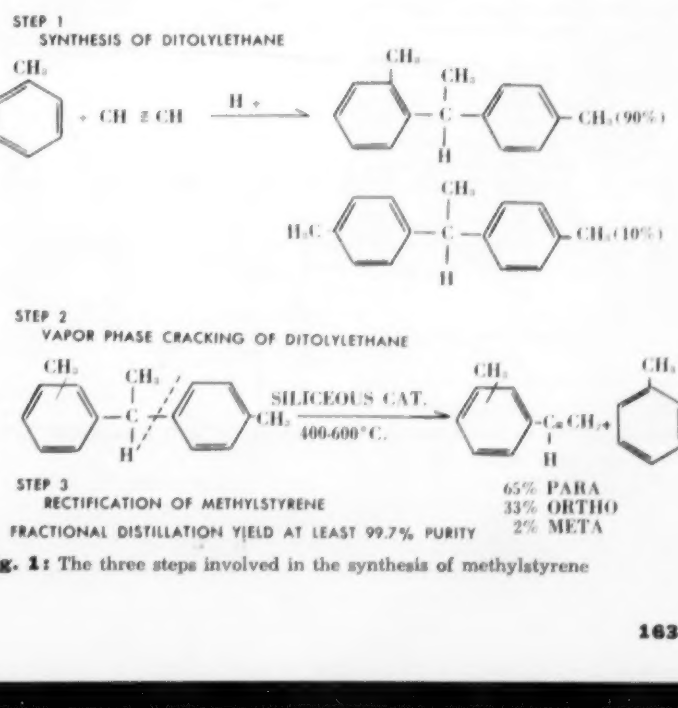

Fig. 1: The three steps involved in the synthesis of methylstyrene

This paper was presented at the 128th meeting of the American Chemical Society, Div. of Paint, Plastics, and Printing Ink.

*American Cyanamid Co.

[1]Numbers in parentheses link to references on p. 252.

Table I: Effect of synthesis process upon isomer composition

Process	*Reactants*	Isomers *Ortho*	Isomers *Meta*	Isomers *Para*
		%	%	%
Ditolylethane	Toluene-acetylene	33	2	65
Ditolylethane	Toluene-acetaldehyde (cat. #1)	12	3	84
Ditolylethane	Toluene-acetaldehyde (cat. #2)	5-10	5-10	90
Dehydrogenation[a]	Toluene-ethylene	2	64	34

[a] R. H. Boundy and R. F. Boyer, "Styrene," 1952. New York: Reinhold Publishing Corp.

mer. The inherent and unique benefits derived from this particular synthesis may be then more readily recognized.

Monomer synthesis

Methylstyrene is prepared by a three-step synthesis as shown in Fig. 1, p. 163. Two moles of toluene are condensed with one mole of acetylene to form a mixture of unsymmetrical ditolylethanes. The ditolylethanes in turn are cracked in the vapor phase to yield one mole of methylstyrene and one mole of toluene for each mole of diarylethane cracked. The methylstyrene consists of a mixture of isomers, 65% para, 33% ortho, and 2% meta. Ethyltoluene and other trace impurities are removed by distillation to yield a product of at least 99.7% purity. The isomer ratio shown above for methylstyrene prepared by the diarylethane process is quite different from methylstyrene prepared by a dehydrogenation process (13), as shown in Table I, above. As will be discussed later the ortho isomer is the preferred isomer since it produces a polymer with a high softening point.

Polymethylstyrene

The polymerization characteristics of methylstyrene produced by the diarylethane process are quite similar to those of styrene. It can be stored at 35° C. under nitrogen for at least 30 days using as little as 10 p.p.m. of inhibitor without any polymer formation. This monomer can be polymerized using bulk, emulsion, dispersion, and solution polymerization methods. The rates of polymerization of methylstyrene, using bulk polymerization at 100° C. with and without catalyst, are comparable to styrene. The rates of polymerization of the individual isomers of methylstyrene have been determined (14) and are, respectively, meta>para>ortho. In contrast, the rate of polymerization of styrene falls between meta and para. The reactivity ratios of these isomers in Cyanamid's methylstyrene are favorable for the formation of a homogeneous polymer.

The effect of isomer composition upon the heat resistance of polymethylstyrene is shown in Fig. 2. The ortho isomer has the optimum heat resistance with the para and meta isomers having, respectively, lower heat resistance. Using the diarylethane process, a very favorable distribution of isomers for high heat resistance is obtained, 33% ortho and only 2% of the least favorable meta isomer. When methylstyrene is produced by the dehydrogenation process, a less favorable isomer distribution is produced.

Polymethylstyrene is an attractive polymer since, in addition to possessing excellent heat resistance, it possesses all the desirable properties of polystyrene. Its dimensional stability as a function of temperature and time is compared to that of polystyrene in Figs. 3 and 4. These data were established on unannealed combs. It is apparent that polymethylstyrene can be employed at service temperatures at least 18° C. higher than that at which polystyrene can be used. The practicability of this improved heat resistance is shown in Fig. 4, wherein after repeated extended exposures to boiling water the ultimate shrinkage was only 0.31 percent.

A typical household application wherein this improved heat resistance may be advantageously

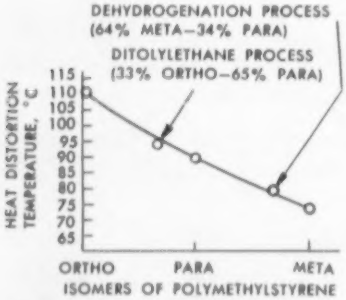

Fig. 2: Effect of methylstyrene isomers on the heat distortion temperature of polymethylstyrene

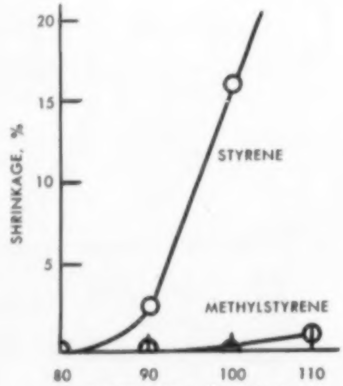

Fig. 3: Percent shrinkage versus temperature of styrene and methylstyrene

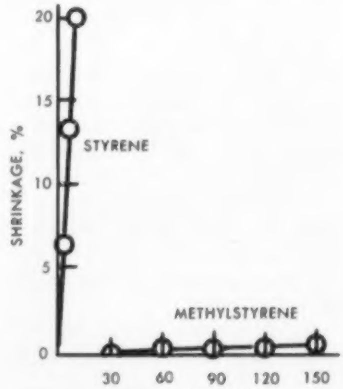

Fig. 4: Percent shrinkage in boiling water of styrene and methylstyrene

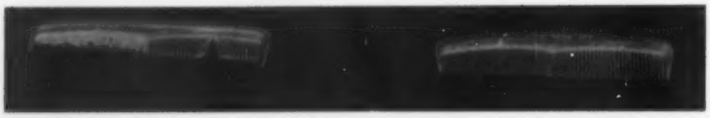

Fig. 5: Effect of immersing a polystyrene comb and a polymethylstyrene comb in water for 30 min. at 100° C. (212° F.). The polystyrene comb is at left, the polymethylstyrene comb at right

Table II: Comparision of physical properties of polystyrenes and polymethylstyrenes

	Polymethylstyrene Diarylethane	*Polymethylstyrene* Dehydrogenation	*Polystyrene* Heat-resistant	*Polystyrene* General-purpose
Distortion[a] at 100° C., in.	0.060	1.0 (4 min.)	0.20 to 1.0 (12 min.)	1.0 (6 min.)
Heat distortion temperature, ° C.	94	78	88 to 93	85
Flexural strength, p.s.i.	11,700	11,500	11,100	10,800
Impact strength (Izod), ft.-lb./in. of notch	0.36	0.35	0.32	0.33
Dissipation factor (10^6 cy.)	0.0009	0.0006	0.0004	0.0007

[a] 264 p.s.i. load on ½- by ½- by 5-in. test bar

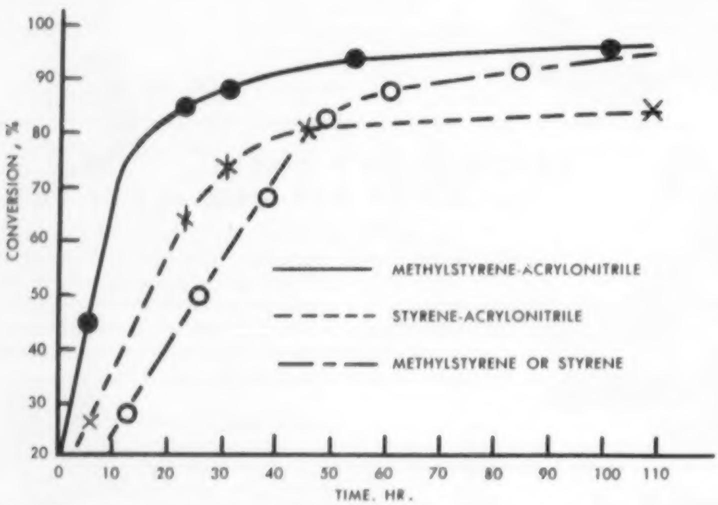

Fig. 6: Polymerization rates of methylstyrene systems at 100° C.

Table III: Physical properties of methylstyrene-acrylonitrile copolymer

	MS-AN	*STY-AN*
Distortion[a] at 100° C., in.	0.060	0.35 to 1.0
Heat distortion temperature, ° C.	95	89 to 92
Flexural strength, p.s.i.	16,000	16,100
Impact strength (Izod), ft.-lb./in. of notch	0.41	0.34 to 0.40
Dissipation factor (10^6 cy.)	0.007	0.006

[a] 264 p.s.i. on ½- by ½- by 5-in. test bar

used is shown in Fig. 5, left. The average dimensional change of the methylstyrene comb after a 30-min. boiling was less than 0.05 percent. Equally promising results have been noted in industrial applications. In a test comparing the heat resistance of polymethylstyrene to that of commercial heat-resistant polystyrenes in two radio cabinets, the cabinet from commercial heat-resistant polystyrenes distorted beyond practical use after a very short exposure to 100° C., whereas the polymethylstyrene cabinets showed no distortion after 30 min. at 100° C. In fact, the dimensional change was less than 0.03 percent.

The general physical properties of polymethylstyrene are compared to those of polystyrene in Table II, left.

Polymethylstyrene has been evaluated in the common makes of injection molding presses as well as in many types of molds. The usual types of mold gating have been employed. In general, polymethylstyrene produced from ditolylethane possesses the excellent moldability of polystyrene and requires but minor alterations in molding conditions. Inasmuch as this polymethylstyrene is a higher softening polymer than polystyrene, somewhat higher molding temperatures are required. A 50 to 75° F. increase in cylinder and mold temperatures is normally used. The same pressures and cycles have been used throughout.

Methylstyrene-acrylonitrile copolymer

The limitations of polystyrenes have been previously discussed. Improvement in such properties as toughness, heat resistance, chemical inertness, and resistance to abrasion and crazing has been obtained through copolymerization with approximately 30% acrylonitrile. Methylstyrene and acrylonitrile copolymerize faster than styrene and acrylonitrile; both of these acrylonitrile systems polymerize faster than styrene or methylstyrene (Fig. 6). In copolymerizing a 70:30 methylstyrene-acrylonitrile system, the reactivity ratios of acrylonitrile

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Grading of polyethylene by ZST test

by H. S. Kaufman and C. O. Kroncke**

The zero strength time (ZST) test was developed as a rapid and reliable technique for the determination of apparent molecular weight of chlorotrifluoroethylene polymers.[1] The test has been adopted by manufacturers and users of these polymers and has proven to be very satisfactory for production quality control of the raw material and fabricated parts. The method is currently being processed for adoption as an ASTM tentative standard method of test.

The success of the method in this application provided impetus to investigate the possible utility of the ZST test for grading other thermoplastics. Some preliminary work with polystyrene, cellulose acetate butyrate, and polyethylene has been done with most encouraging results. The detailed data on results of ZST tests which have been conducted on polyethylene will be presented in this article.

Nature of test

The ZST test measures the time required to break a standard notched strip of polyethylene heated in a constant temperature furnace and weighted with a standard load. The apparatus, designed to make this measurement semi-automatically, is called the "Kellogg ZST Tester"[2] and is identical with that previously described for application to "Kel-F"[3] polymers. The ZST tester and the cutting and notching tools[4] for use with the tester are available commercially.

The temperature of operation of the ZST tester depends upon the first order transition temperature of the polymer material being tested.

For polyethylene measurements were made at 130 to 175° C. The specimen is prepared from a compression molded test sheet 1/16 in. in thickness. The test sheets are conveniently prepared using a laboratory press with platen temperatures of 150° C. About 20 grams of polymer are placed on a thin polished metal plate and covered by a similar plate. Two spacers 0.075 ±0.001 in. are placed between the plates on either side of the polymer at a distance so as not to interfere with the flow of the polymer. This assembly is placed in the heated press. Sufficient pressure is applied to maintain contact of the

(To page 254)

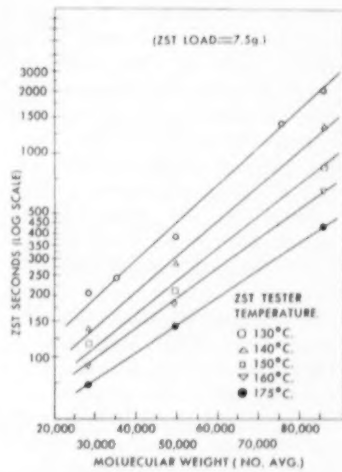


Fig. 1: Measured ZST values plotted logarithmically against molecular weight indicate linear relationship between ZST and molecular weight at every tester temperature

Table I: ZST values for Bakelite polyethylenes

Bakelite designation	*Viscosity avg. molecular wt.*[a]	*ZST value*	*Melt index*
		sec.	*g./10 min. at 190° C.*
DYNB	—	94	21
DYNF	19,000	132	2.30
DYNH-1	20,000	138	1.94
DYNJ	22,000	150	0.92
DYNK	25,000	163	0.30

[a]Carey, R. H., SPE J. *10*, 16 (Mar. 1954)

Table II: ZST values for Du Pont polyethylenes

Du Pont designation	*ZST value*	*Melt index*	*Softening point (Vicat)*	*Tensile strength at 73° F.*
	sec.	*g./10 min.*	*° F.*	*p.s.i.*
Alathon 3	204	0.3	—	—
Alathon 10	132	2.1	201	1750
Alathon 14	106	2.1	176	1420
Alathon 20	126	2.2	208	2000

*The M. W. Kellogg Company.

[1]"Determination of apparent molecular weight of polychlorotrifluoroethylene," by H. S. Kaufman, C. O. Kroncke, and C. R. Giannotta, *Modern Plastics*, 32, 146 (Oct. 1954).

[2]"Kellogg ZST Tester" is the trademark of The M. W. Kellogg Company.

[3]Kel-F is the registered trademark of The M. W. Kellogg Company for its fluorocarbon products.

[4]Available from the F. J. Mullowney Co., Trenton, N. J.

Plastics Digest*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. For complete articles, send requests direct to publishers. List of addresses is at the end of Plastics Digest.

Materials

Fillers and pigments for polyesters. Canadian Plastics *1955*, 46-47, 55, 57, 59 (Aug.). Proper use of extender pigments can improve quality while reducing cost of polyester laminates. For coloring, pigment pastes are very efficient but are expensive; a more popular form of pigment is the dispersable powder which is simply stirred into the liquid polyester resin. If the amount of pigment is small, however, then the liquid resin should be blended, a portion at a time, into the pigment to utilize the shearing action of a thick paste. Not all paint pigments are suitable for polyesters. Some pigments reduce curing speed, but this can be remedied by adjusting catalysts. A wide variety of colors can be made by blending a few base colors. Titanium dioxide pigments are excellent for use with polyesters and may be extended with chalk and barium sulphate. Lithopone whites sometimes cause trouble in polyesters. The blackest blacks are lamp blacks, but care must be exercised in their use because they slow the curing process. Bone black, though not so dense in coloring effect, does not affect rate of cure. Iron black works satisfactorily though it tends to speed up the cure. The most successful red for all-around polyester work is toluidine red. Chrome yellows, either pure or extended, are highly satisfactory. Prussian blue works well; also, phthalocyanine blue. Chrome greens are suitable. Extender pigments most commonly used with polyesters are chalk, talc powder, silica, and certain types of bentonite clay. These lower the cost, reduce the violence of the exotherm during cure, and provide control of viscosity. In polyester-glass laminates, the function of the resin is to wet and hold the glass fibers. The space between the fibers does not have to be filled with pure resin; a good extender can fill this space economically while improving properties, except where translucency is required. An ideal extender would have the low cost of chalk but a lower weight per unit volume than the resin. The scrap urea, melamine, and phenolic resin which is presently being burned may, however, eventually prove to be effective extenders.

New epoxide resins by reaction of epichlorohydrin with sulfonamides. M. Cohen. Ind. Eng. Chem. *47*, 2095-2101 (Oct. 1955). Like the bisphenols, primary aromatic sulfonamides, such as *p*-toluenesulfonamide, react with epichlorohydrin in alkaline solution at moderate temperatures to form epoxide-containing products. However, unlike the reaction products of bisphenols with epichlorohydrin, these products cannot be gelled by amine or anhydride catalysts and will condense further to products of no epoxide content unless the reaction conditions are carefully controlled. The epoxide-containing products can also be formed by employing a very large excess of epichlorohydrin. Like phenols, secondary aromatic sulfonamides react with epichlorohydrin in alkaline solution to form epoxide-containing products. These can react further with excess sulfonamide to form hydroxyl-containing derivatives. Depending on their structure, certain disecondary sulfonamides react with epichlorohydrin to form one of two products—either high melting products of low epoxide content or products of appreciable epoxide content. Like the bisphenol-based resins, the latter materials can be gelled by amine or anhydride catalysts. The tendency of the disecondary sulfonamides to form one or the other of these products can be correlated with their ease of ring formation. This cyclization hypothesis can be extended as one possible explanation of the reaction products observed with *p*-toluenesulfonamide and epichlorohydrin.

Molding and fabricating

Thermoplastic sheet production. Plastics (London) *20*, 309-313 (Sept. 1955). A new British plant is described for the manufacture of thermoplastic sheet up to 5 ft. in width. Three methods of sheet manufacture are used: sheets are molded from powder of special particle size in steel "picture frame" molds; calendered sheet is laminated up to ½-in. sheets from base stock 10 mils thick; and extruded sheet is used in a similar lamination process. Among the materials to be handled are high-impact polystyrene, polyethylene, cellulose acetate, unplasticized polyvinyl chloride, and foamed polystyrene slabs. A 2100-ton vertical upstroking hydraulic platen press is used with a platen area 64 by 64 inches.

Applications

European developments in the dielectrics field. G. De Senarclens. Electrical Mfg. *56*, 119-25 (Aug. 1955). Dielectric materials found successful on one side of the Atlantic soon appear on the other side. Insulating materials that have lately found applications of major scope in Europe include cellulose acetate paper for cable insulation, capacitor dielectric, and laminates; epoxy resins for casting instrument transformers, capacitors, line insulators, and for impregnated mica foil for bar insulation in rotating electrical machines; polyurethane wire enamel that is strippable in a tin bath at 350° C.; polyvinyl chloride for spiral multicolored wire in telephone cable applications where a variegated assortment of identifiable patterns are required;

*Reg. U. S. Pat. Off.

and expanded polystyrene for floats, thermal insulation, and possibly as a dielectric in high-frequency telecommunications.

Foamed in the mold. Modern Packaging *29,* 116-17, 224, 226 (Sept. 1955). Two commercial packaging applications of the new moldable foamed polystyrene material are described. They are a re-usable fishing reel and tackle box for a spinning reel set, and a gift shipping container for nuts re-usable as a tray. The expandable polystyrene provides a lightweight protective package which can be designed with form-fitting recesses and removable trays in a wide decorative and color range.

Properties

Effects of water immersion and humidity on thermosetting laminates. R. R. Winans, N. Fried, and W. Hand. Electrical Mfg. *56,* 106-13 (July 1955). The results of investigations on the effects of humidity and water immersion on the electrical and mechanical properties of fabric-phenolic, paper-phenolic, glass-melamine, and glass-silicone laminates are presented. The behavior of these materials in recovering from the effects of humidity and water immersion is also reported. Electrical properties investigated include dielectric strength in directions parallel and perpendicular to forming pressure, dielectric constant and dissipation factor at several frequencies, and d.c. volume and surface resistances. Sea-water conditioning produced the most rapid and widespread deterioration of electrical properties and prevented full recovery of the materials; an increase in the temperature of the immersion medium considerably accelerated the deterioration of the phenolic laminates. Mechanical properties studied were flexural and compressive strength in both the flatwise and edgewise directions. The progressive effects of immersion in both distilled water and synthetic seawater at temperatures of 30 and 50° C. are discussed as well as the effects of prolonged drying following the various immersion cycles. All the laminates investigated suffered degradation of mechanical properties under conditioning. Although some recovery was effected upon drying, original strength was rarely attained. The glass-silicone laminate, however, was only slightly affected by immersion and, upon recovery through drying, showed negligible permanent deterioration. Results of the 4500-hr. immersion tests demonstrated the hazards of drawing conclusions about insulating materials on the basis of short-duration conditioning. The prevalent practice of employing 24- or 48-hr. immersion tests does not permit reliable evaluation of the ultimate moisture resistance characteristics of materials.

Polyethylene bottle deformation. P. J. Carter and W. C. Griffin. Modern Packaging *29,* 166-70, 233-34 (Sept. 1955). A brief study was made to determine the effect of materials such as mineral oils, vegetable oils, fatty alcohols, fatty acids, and surfactants on the deformation of polyethylene bottles during shelf storage. Tests show that isopropyl myristate-palmitate mineral oils, oleic acid, and oleyl alcohol cause extreme deformation of the bottles during storage. Water, persic oil, and several non-ionic surfactants had little effect. It was concluded that collapse was caused by softening of the bottles, resulting in increased total capacity and decreased pressure. It was also found that the deleterious effect of mineral oil on polyethylene bottles can be minimized by packaging only stable oil-in-water emulsions in this type of container as opposed to water-in-oil emulsions.

Problems of electrostatic charges in plastics. Brit. Plastics *28,* 335-37 (Aug. 1955). The generation of static electricity in electrical insulants such as plastics occurs in general when friction or making and breaking of contact occurs between two surfaces, as in calendering. The charges can lead to material sticking together and dust pick-up. Spark discharges can be unpleasant to individuals or can be dangerous in certain atmospheres. A portable electro-

meter is described for measuring the magnitude of an electrostatic field. Two methods of dissipating charges are in general use: 1) ionization of the air either by means of a silent discharge or by means of radioactive material and 2) making the material conductive by coating its surface with a suitable dressing. The former is more suitable to processing applications while the latter is largely confined to finished material and moldings. Commercial ionization equipment is described. Destaticizing compounds include fillers such as conducting carbon blacks, lacquers, and solutions of compounds such as detergents, salt sprays, and a quaternary ammonium salt.

Problems of adhesion. V. Deryagin. Research 8, 70-74 (Feb. 1955). Some recent Russian work on the nature of adhesion is reviewed. It is suggested that there is a double layer of positive and negative charges at the surface and energy is required to separate these charges. This idea is based upon the crackling sound and sparks observed when some materials including adhesive tape are stripped off in the dark.

Burning behavior of some cellulose ester film compositions. C. J. Malm, N. G. Baumer, and G. D. Hiatt. Ind. Eng. Chem. 47, 2521-23 (Dec. 1955). Addition agents capable of forming an inorganic acid at high temperature cause cellulose ester test strips to burn slowly and the flame to go out repeatedly. Organic phosphate esters impart different degrees of flame-inhibiting action, depending on their instability to heat and/or volatility. Low levels of phosphoric or sulfuric acid have antiflame activity. Neutralizing this acidity with a strong base destroys the flame-inhibiting properties, but salts of these acids have the same effect as the acids.

Testing

Determination of mixed phthalic acid isomers in alkyd resins. M. H. Swann, M. L. Adams, and D. J. Weil. Analytical Chem. 27, 1604-06 (Oct. 1955). The meta and para isomers of phthalic acid have recently attained com-

mercial significance in alkyd resin manufacture. An analytical method for measuring each of the three phthalic acid isomers in mixture consists of a special saponification technique to recover the acids from resin solution, followed by hydrolysis in methanol solution and measurement of the absorptivity at three ultra-violet wavelengths. Analytical control can be exercised on the new compositions.

Polarographic determination of phthalic anhydride in alkyd resins. P. D. Garn and E. W. Halline. Analytical Chem. 27, 1563-65 (Oct. 1955). This method for the determination of total phthalate as phthalic anhydride in alkyd resins and resin solutions is not subject to interference from other dibasic acids or cellulose nitrate. The method consists of saponifying the sample, dissolving the precipitated potassium phthalate alcoholate in aqueous sulfuric acid, and measuring the diffusion current at a dropping mercury electrode. Phthalic acid yields a well-defined polarographic wave in aqueous sulfuric acid when tetramethylammonium bromide is the inert electrolyte. The wave height is proportional to the concentration. The diffusion coefficient for phthalic acid in this solvent is 8.6×10^{-6} cm.^{2} sec.$^{-1}$ The method permits determination of phthalate more quickly than by simple precipitation of potassium phthalate alcoholate. Terephthalic, isophthalic, succinic, sebasic, and adipic acids do not interfere. Interference from maleic or fumaric acids or cellulose nitrate may be eliminated by a controlled potential electrolysis.

Publishers' Addresses

Analytical Chemistry: American Chemical Society, 1115 Sixteenth St., N. W. Washington 6, D. C.
British Plastics: Iliffe and Sons, Ltd., Dorset House, Stamford St., London S. E. 1, England.
Canadian Plastics: Monetary Times Printing Co., Ltd., 341 Church St., Toronto 2, Ontario, Canada.
Electrical Manufacturing: The Gage Publishing Co., 1250 Sixth Ave., New York, N. Y.
Industrial and Engineering Chemistry: American Chemical Society, 1115 Sixteenth St., N. W. Washington 6, D. C.
Modern Packaging: Modern Packaging Corp., 575 Madison Ave., New York 22, N. Y.
Plastics (London): Temple Press Ltd., Bowling Greene Lane, London E. C. 1, England.
Research: Butterworth Scientific Publications, 88 Kingsway, London W. C. 2, England.

U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each

Interpolymers. W. F. Fowler, Jr. and D. D. Reynolds (to Eastman Kodak). U. S. 2,721,852, Oct. 25. Interpolymers of vinylpyridines, acrylic esters, acrylic amides, and styrenes.

Resins. C. F. Kohl (to Dow Corning). U. S. 2,721,854, Oct. 25. Polyvinyl acetal modified silicone alkyd resins.

Resins. M. Kin (to Dow Corning). U. S. 2,721,855, Oct. 25. Air-drying organosilicon composition containing a titanic ester.

Siloxanes. L. H. Sommer (to Dow Corning). U. S. 2,721,856, Oct. 25. Siloxanes containing carboxy groups.

Elastomers. N. G. Dickmann (to Dow Corning). U. S. 2,721,857, Oct. 25. Organosiloxane elastomers containing boron compounds.

Vinyl chloride. A. W. Fuhrman (to U. S. Rubber). U. S. 2,721,859, Oct. 25. Plastisol-grade polyvinyl chloride which is prepared by spray drying.

Heat sealing. N. Langer. U. S. 2,721,925, Oct. 25. Heat sealing machine.

Printing. E. A. Freund. U. S. 2,722,-038, Nov. 1. Process for printing on plastics.

Conductors. R. H. Ralston (to Hercules). U. S. 2,722,492, Nov. 1. Conductors insulated with homopolymers of 3,3-bis(chloromethyl) oxetane.

Coated fabric. W. D. Hedges (to Columbus Coated Fabrics). U. S. 2,722,495, Nov. 1. Vinyl coated fabrics.

Polymers. G. E. Hulse (to Hercules). U. S. 2,722,520. Nov. 1. Oxetane polymers.

Resins. A. W. Shaw and C. B. Linn (to Universal Oil). U. S. 2,722,521, Nov. 1. Polymers of polycarboxylic acids and a diaryl desoxy-glucitel.

Coating. A. E. Gilchrist, L. D. Harrup, R. C. Hendrickson, and D. T. Rehor (to Glidden). U. S. 2,722,523, Nov. 1. Water-soluble coating.

Polymers. S. B. Speck (to Du Pont). U. S. 2,722,524, Nov. 1. Linear condensation polymers containing silicon.

Polymers. J. A. Price and J. J. Padbury (to American Cyanamid). U. S. 2,722,525, Nov. 1. Polymerizable compositions containing an unsaturated carbonate.

Cellulose plastics. W. B. Johnson (to Hercules). U. S. 2,722,528, Nov. 1. Finely divided cellulose plastics.

Laminates. W. J. Hampshire, J. C. Coomes, and R. A. Motz (to Goodyear Aircraft). U. S. 2,722,962, Nov. 8. Void-free fabric laminates.

Containers. W. J. McCune, Jr. (to Polaroid). U. S. 2,723,051, Nov. 8. Disposable plastic containers.

Mineral fibers. A. R. Morrison (to Owens-Corning). U. S. 2,723,208, Nov. 8. Sizing mineral fibers with polymide resin.

Armor. E. A. Meyer (to Bjorksten Research). U. S. 2,723,214, Nov. 8. Projectile-resistant armor.

Polymers. R. M. Joyce, Jr. and J. R. Roland (to Du Pont). U. S. 2,723,244, Nov. 8. Diaminotriazine diamine condensates.

Ion exchange. R. M. Wheaton (to Dow). U. S. 2,723,245, Nov. 8. Regenerating quarternary ammonium ion-exchange resins.

Polymers. R. C. Harrington, Jr. (to Eastman Kodak). U. S. 2,723,247, Nov. 8. Acrylonitrile polymer solutions which are contained in ethylene oxamates.

Films. G. C. Wright (to General Aniline). U. S. 2,723,248, Nov. 8. Polymeric N-vinyl lactam film.

Resins. M. De Groofe (to Petrolite). U. S. 2,723,249-50-1-2, Nov. 8. Phenolic resins reacted with vinyl glycidyl ether.

Resins. J. W. Wandell (to S. Haas). U. S. 2,723,253, Nov. 8. Urea resins.

Copolymers. D. W. Chaney (to Chemstrand). U. S. 2,723,254, Nov. 8. Copolymers of acrylonitrile and N-substituted sulfonamides.

Resins. W. F. Busse and M. A. Smook (to Du Pont). U. S. 2,623,255, Nov. 8. Ester derivatives of chlorosulfonated hydrocarbon polymers.

Polymers. M. Hayek (to Du Pont U. S. 2,723,256, Nov. 8. Polymeric alkyl sulfate quaternary ammonium salts of the acrylyloxyethylamine type.

Polymers. A. McAlevy (to Du Pont). U. S. 2,723,257, Nov. 8. Vulcanized chlorosulfonated polymers.

Acrylonitrile. J. A. Price (to American Cyanamid). U. S. 2,723,258, Nov. 8. Polymerized acrylonitrile copolymers.

Polymer. S. S. Kurtz, Jr. (to Sun Oil). U. S. 2,723,259, Nov. 8. Vinyl naphthenate polymer.

Copolymers. D. T. Mowry and R. R. Morner (to Monsanto). U. S. 2,723,260, Nov. 8. Copolymers of vinyl chloride and cyano ether esters.

Polymers. I. E. Levine and W. E. Elwell (to California Research). U. S. 2,723,261, Nov. 8. High-melting polymers of *p-tert*-butylstyrene.

Strip. J. Veit (to Duratube and Wire). U. S. 2,723,424, Nov. 15. Patterned thermoplastic strip.

Tubing. P. H. Pelley (to Beech Aircraft). U. S. 2,723,426, Nov. 15. Reinforced plastic tubing.

Coating. G. Mason, J. B. Mason, A. M. Mason, and B. Mason (to Mason Plastics). U. S. 2,723,647, Nov. 15. Coating elongated articles.

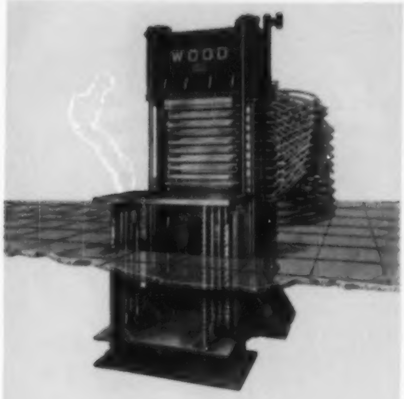
Laminates. H. W. Collins (to Owens-Corning). U. S. 2,723,705, Nov. 15. Cylindrical reinforced laminates.

Sheet. E. A. Rodman (to Du Pont). U. S. 2,723,935, Nov. 15. Non-woven terephthalate ester filaments bonded with an organic diisocyanate.

Film casting. W. D. Hedges and J. C. Lowman (to Columbus Coated Fabrics). U. S. 2,723,962, Nov. 15. Continuously coating a fabric with vinyl film.

Non-flammable plastic. R. M. Price and A. F. Roche (to Dow). U. S. 2,723,963, Nov. 15. Organic polybromides are added to flammable plastic.

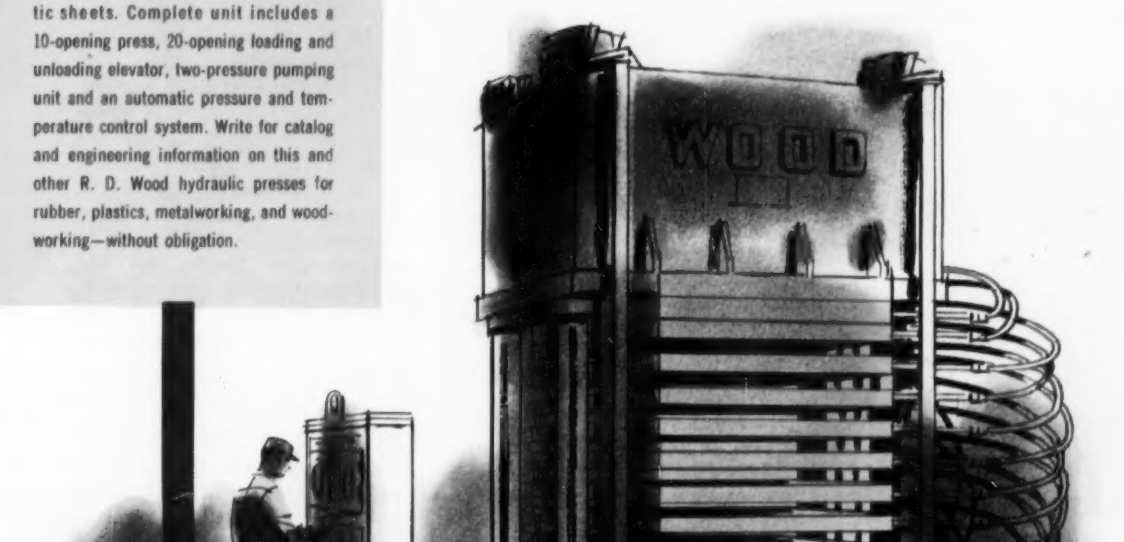
Elastomers. E. L. Warrick (to Dow Corning). U. S. 2,723,964, Nov. 15. Organosiloxane elastomers.



880-ton Multiple Opening Platen Press (HydroLectric). This precision press is designed for polishing and laminating plastic sheets. Complete unit includes a 10-opening press, 20-opening loading and unloading elevator, two-pressure pumping unit and an automatic pressure and temperature control system. Write for catalog and engineering information on this and other R. D. Wood hydraulic presses for rubber, plastics, metalworking, and woodworking—without obligation.

Presses that set performance records

Gratifying things begin to happen when you put an R. D. Wood press in your plant. First of all, you'll probably notice a higher rate of production. Next, downtime for maintenance shrinks to a minimum. Finally, quality of work is improved. *Smooth, troublefree performance* underlies all of these advantages. And this, in turn, results from the scrupulous design, superior materials, and painstaking workmanship that go into *every* R. D. Wood press. Since 1803, our nameplate has stood for unquestioned excellence.



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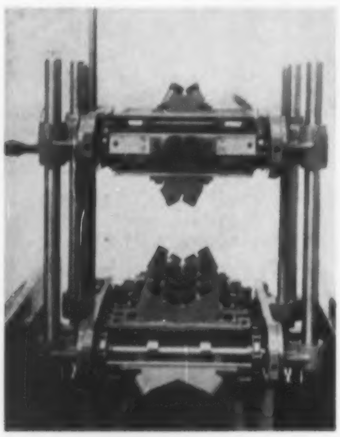
New Machinery and Equipment

Pipe take-off and cutter

A double caterpillar-like device is the heart of a new take-off unit for drawing extruded PVC pipe through the cooling bath. Companion unit is a high-speed rotating cutter that advances with the pipe as it cuts, snaps back when cut is completed. The take-off is equipped with a drive giving 6-to-1 speed variation and is capable of handling pipe in a wide range of sizes. Two sets of knives are furnished with the cutter, one for pipe from 1 to 4 in. in diameter, the other for 4- to 8-in. pipe. *Carlo Pasquetti and Co., Via Savito Silvestro, 103, Varese, Masnago, Italy.*



Close-up of Pasquetti's draw-bench, showing upper and lower endless belts with caterpillar feet that grip pipe

Nylon drying oven

A new oven designed especially for drying nylon and other thermoplastic molding materials has a built-in filter and dehumidifier on its air intake. The design of the oven incorporates numerous suggestions offered by Du Pont and other technical service engineers concerned with the problem of drying molding compounds and by nylon molders.

The dehumidifier is capable of removing over 24 lb. of water a day from the air used to dry the material. Powered at 10 kw., the oven can operate continuously at 500° F. (260° C.) and, after being opened, can recover to its normal operating temperature of 175° F. in 2 to 5 minutes. It contains 12 drawers, each 15 by 30 by 2 inches. When a drawer is removed to take out the inner pan or liner, the drawer opening seals off to hold in the heat. A ½-hp. fan insures evenness of temperature throughout the oven. *Injection Molders Supply Co., 3514 Lee Rd., Cleveland, Ohio.*

Pasquetti's draw-bench, shown taking rigid polyvinyl chloride pipe from cooling bath (left) and feeding it to rotary cutter (right)

Feeder for polyester rope

A new rope-feeding attachment for plastics molding presses makes it possible to mold automatically the glass-reinforced polyester resins which are currently being supplied in the form of extruded rope.

The Stokes rope feeder was developed for use with Stokes Model 741 presses, but may also be used with other presses. The attachment can feed any number of cavities, located over the whole area of the platen, in any arrangement, and with different molds. It can be adjusted to feed the various diameters of rope commercially available and to cut whatever lengths are required for the parts that are being molded. *F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa.*

Marking machine

Semi-automatic imprinting of sizes, designs, etc., on flat parts, products, or packages at rates up to 75 pieces per min. is reported possible with the 25AF Markem machine. The maximum imprint area ranges from 2.8 by 9 to 5 by 11 in., depending on whether masterplates, typebars, or rubber plates are used. Marking compounds are available in many colors. *Markem Machine Co., Keene 54, N. H.*

Injection machine

A new addition to the HPM line of injection molding machines is the 48-64-oz. machine (capacity in polystyrene), Model 800-H-48. The machine features a high injection speed of 2410 cu. in./min., a mold-mounting area of 36 by 54 in. and a 35-in. mold clamp stroke. It comes equipped with an automatic weigh feeder, a two-speed injection pump and dual pressure injection, permitting the injection pressure to be reduced automatically after the mold cav-

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Check these outstanding features of this ultra-modern Van Dorn injection press:—

GREATER CAPACITY— Up to 2½ oz.; smaller pieces at faster cycles.

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FASTER PRODUCTION—Will attain up to 720 cycles per hour (dry run).

HIGHEST EFFICIENCY—Due to water cooling of injection plunger, transfer hopper and oil cooler.

ACCESSIBILITY— Due to simple platen clamp device for purging to change material or color.

MORE SAFETY— Mold hydraulic mechanism makes press non-operative unless molded part is completely ejected.

SIMPLER OPERATION—Due to automatic, adjustable material metering device.

MULTIPLE OPERATIONS—Minimum operator attention by use of larger hopper and light that indicates when press needs attention.

SELECTIVE CONTROL—Merely throw toggle switch to operate press semi-automatically.

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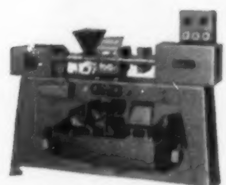
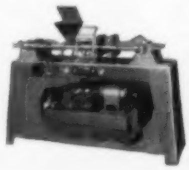
and this Van Dorn model is the lowest priced press in its class!

Write for complete data on Model H-250 and other equipment shown. FINANCING AVAILABLE

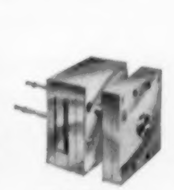


SEMI-AUTOMATIC PRESS
2-oz. capacity.

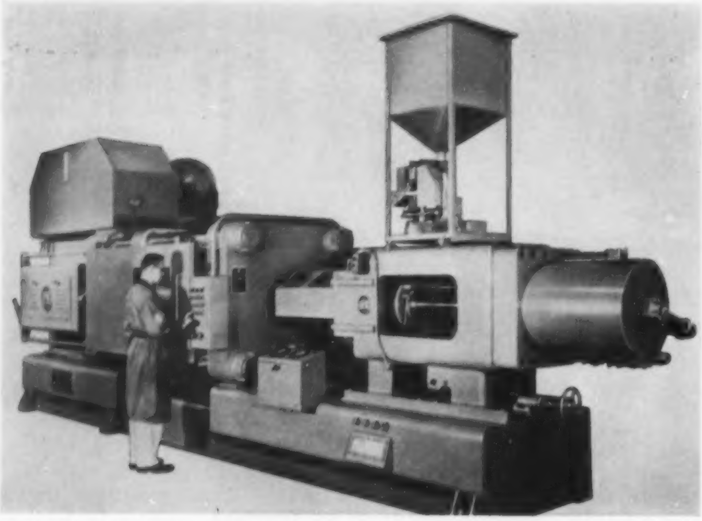


POWER OPERATED, LEVER CONTROLLED PRESSES
2-oz. and 1-oz. models

PLASTIC GRINDER
Grinds up rejects, waste, etc., for re-use.



MOLD BASES
Available from stock.



H-P-M's Model 800-H-48 injection molding machine has a rated injection speed of 2410 cu. in./min. and a 35-in. mold clamp stroke

ities have been filled. The all-hydraulic mold clamp is claimed to eliminate time-consuming adjustments usually necessary to compensate for differences in the thicknesses of different molds.

Length of hydraulic piping has been greatly reduced, all hydraulic components are mounted in the open for easy access, and a front limit-switch panel permits all stroke adjustments to be made at the front of the machine. *The Hydraulic Press Mfg. Co., Mount Gilead, Ohio.*

Thickness analyzer

Used with Tracerlab's beta-ray gages, a new analyzer automatically classifies sheet production and records the amounts produced in these five groups: 1) within tolerances, 2) from lower tolerance limit to 10% above upper limit, 3) from 10% below lower limit to upper limit, 4) thicker than 10% above upper limit, and 5) thinner than 10% below the lower limit. The choice of production units to be registered is open. *Tracerlab, Inc., 130 High St., Boston 10, Mass.*

Control equipment

Designated Spectrostats, this line of instruments provides a method of quality control through the use of wavelength absorption from a continuous flow of materials or products. Gases, liquids, slurries, sheets, or a flow of unit solids may be monitored. The Spectrostat provides continuous sampling and indicates the direction of deviation beyond the set limits by a visual and/or audible warning. A 50-mv. proportional output provides direct process control.

Underlying the operation of this instrument is the fact that in most process operations, a change in color (absorption band) is caused by contamination or change in concentration of the components of interest. The Spectrostat monitors the spectral bands of the contaminant or diluent in the product in a range from a few parts per million upward. A color change beyond the tolerance limits indicates the need for corrective action. *Kaye Development Co., South Norwalk, Conn.*

Hardness tester

Air-operated, semi-automatic Air-O-Brinell is claimed to provide positive application of standard Brinell test loads of 500, 1000, 1500, 2000, and 3000 kg., thanks to a gage mounted at the top of the machine which shows what load will be applied *before* the test is made. To use the machine, an operator adjusts the air pressure regulator valve until the desired Brinell load is indicated on the gage. Once the load is set, any number of hardness tests can be made. Load is applied by pulling out a plunger-type control valve; it is released instantly by pushing it in. The equipment operates from standard compressed air supply. Fluctuations in air pressure above 65 p.s.i. are said not to affect the accuracy of the machine. *Tinius Olsen Testing Machine Co., 6102 Easton Rd., Willow Grove, Pa.*

Test chamber

Redesigned line of Weather-Lab environmental test chambers includes units with from 10 to 40 cu. ft. working space, 30 to 200° F. temperatures, and 20 to 95% relative humidities. The chambers are of stainless steel inside and out, with built-in refrigeration, lights, wet and dry bulb thermostats, electric heaters, and blowers. The 10-cu. ft. model has a single door, other models have double doors. The chamber can be used for testing according to MIL and JAN specifications on a large range of materials. *Hudson Bay Co., Div. of Labline, Inc., 3070 W. Grand Ave., Chicago 22, Ill.*

Plastic-coating equipment

Making use of a fluidized bed of plastics particles, a new device deposits coatings up to 3/16 in. thick on even the most intricate shapes. Coating may be done in either of two ways: 1) The article to be coated is preheated in an oven or flame to a temperature well above the plastic melting point, then dipped in the highly turbulent bed of particles for a few seconds. When it is withdrawn, residual heat melts and levels the adhering particles

American Agile's device for depositing coatings up to 3/16 in. thick

to a non-porous coating. 2) The fluidized powder may be sprayed on preheated articles too large to immerse in the bed. *American Agile Corp., 5461 Dunham Rd., Maple Heights, Ohio.*

Colorimeter

Model IV Colormaster is a differential colorimeter claimed to make color measurements with a sensitivity exceeding that of the human eye. It measures color transmission and reflectance within 0.0001 reflectance units. A digital reflectance indicator is calibrated to 0.0002 reflectance units. A spinning attachment to permit rotation of samples is optionally available. A scale multiplier which will permit scale expansion by a factor of ten is reportedly under development at the present time.

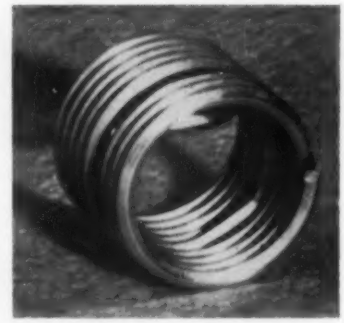
The manufacturer states that the Colormaster is especially useful for measuring differences between colors for process control applications. *Manufacturers Engineering & Equipment Corp., Hatboro, Pa.*

Void detector

Consisting of an ultra-sonic f.-m. transmitter and receiver to produce and monitor a sound beam through a piece under test in a tank of oil or water, a new instrument locates voids in laminar plastics and metals, welding flaws, and plastics moldings defects. It includes an alarm buzzer which automatically sounds when a void is detected. The buzzer signal can be adjusted to be used as a "go-no go" signal for quality control work. An indicating meter provides a visual percentage reading of the void signal. Operators can be trained in a few minutes to work the equipment. *Sunshine Scientific Instrument, 1810 Grant Ave., Philadelphia 15, Pa.*

Screw-locking device

A new solution to the problem of locking screw fasteners against loosening by vibration is the Mid-Grip screwlock insert. The hole that receives the screw is drilled but not tapped. Instead, the helical Mid-Grip (see photo above), the central coils of which are octagonal, is installed in the hole with special tools made for the



Heli-Coil's Mid-Grip inserts lock screw fasteners against loosening by vibration

purpose. The screw is then driven as into a tapped hole and is securely locked by the octagonal coils. Now made in sizes 10-32, ¼-28, 5/16-24, and ⅜-24, with others to be available soon. *Heli-Coil Corp., Danbury, Conn.*

Finishing equipment

Air-cooled bias buffs have 45-degree fabric biasing which is claimed to produce 23% more warp fibers per inch of fabric on working surface of buff than non-bias fabric. The fabric is mounted in uniform convolution pleats, which the manufacturer states eliminates down-time for balancing polishing heads. Forced air ventilation through air scoops in the center of the buff provides cooling action.

The fabric is attached to the wheel with piano wire stitches for safety at maximum-speed operations. *James H. Rhodes & Co., 157 W. Hubbard St., Chicago 10, Ill.*

Automation equipment

Infra-red analyzer is designed for use in automatic processing of plastics, rubber chemicals, petroleum, and other products.

Operated in conjunction with narrow-band infra-red, ultraviolet, and visible light filters, it permits the study of gaseous or chemical constituents by emission, transmission, or absorption spectroscopy. According to the maker of the instrument, spot analysis measurements can be made by non-technical personnel using the narrow band filters and dials and meters on the equipment.

The analyzer measures 8 by 8½ by 13 in., operates on a.c., and in-

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corporates a PbS detector and power supply. *Axler Associates, Inc., 102-42 43rd Ave., Corona 68, N. Y.*

Insulating joints

This line of revolving joints is used in cooling and heating of calendering rolls and the like. Because there is an insulating space between the two passageways through the joint, the hot-water return from a roll will not preheat the cold feed water. The insulating space also makes it possible for the same joint to be used as a jacketed water or steam joint. When used as a steam jacketed unit, liquid going through the joint can be preheated. In cases where the heating medium is toxic, water flushing will dissipate any toxic fumes that might develop. *Rothern Engineering Co., Inc., 7280 W. Devon Ave., Chicago 31, Ill.*

Vacuum forming machine

Model 3242 vacuum forming machine is equipped with two operating stations; heating of the plastic material takes place at one position while the vacuum forming, cooling, releasing of the completed form, and placing of a new sheet take place at the other. The two stations are adjacent, so that the oven does not travel over nonreproductive areas, nor is the sheet removed from the oven area and exposed to cooling before the vacuum is pulled.

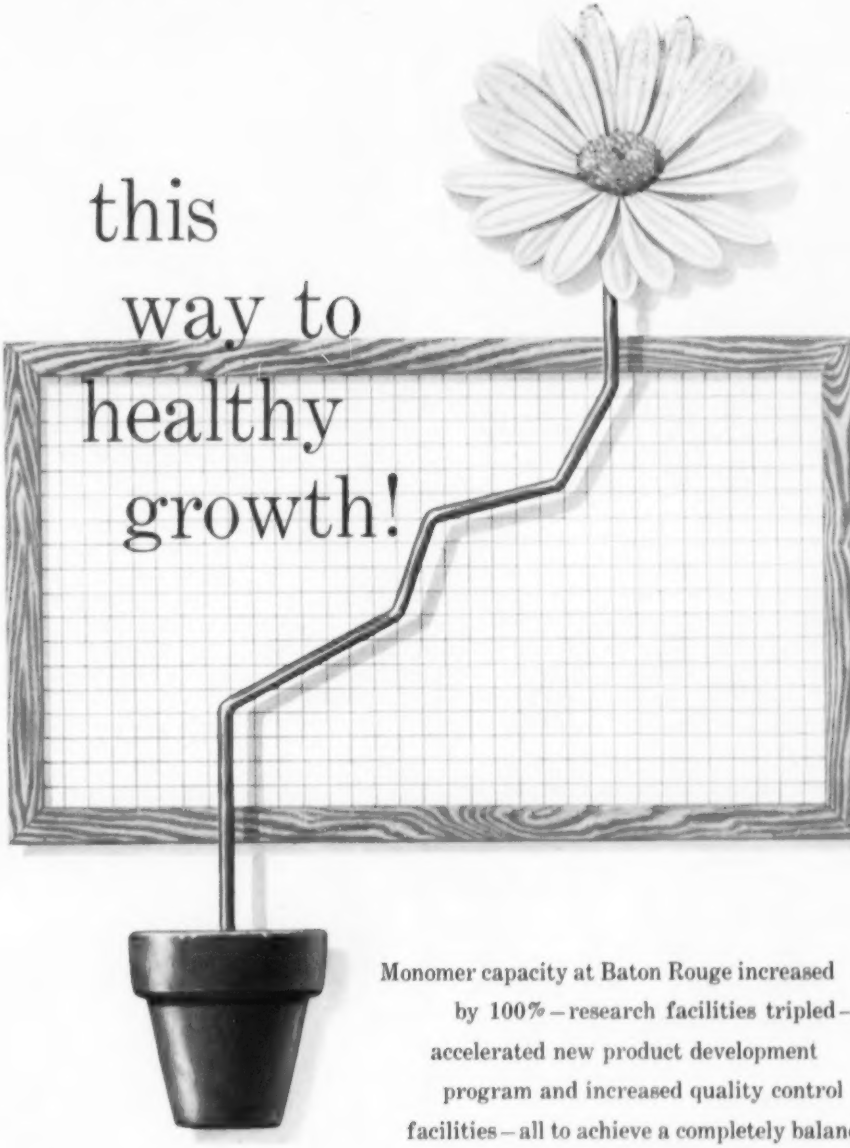
The machine can form sheets from 20 by 20 to 60 by 91 in.; the basic machine has a vacuum drawing area of 31 by 41 inches. The basic oven is also designed for this size. If larger-size sheets are to be formed, alternate tables and ovens can be attached.

Each station is independently controlled so that different jobs may be run at each end. Oven travel is power-operated and adjustable as to speed. Release of formed pieces is accomplished by a valving arrangement that opens and admits a rush of filtered air to the back side of the sheet. Safety limit control on oven acts as guard against overheating of plastic.

Vacuum pump with 9.3-cu. ft./min. capacity is driven by a ½-hp. motor and has a reserve tank of 30-gal. capacity. The pump provides a 24-in. Hg operating vacuum. Pump and tank are integral.

An air compressor, consisting of an integral pump motor and filter system is included, making the machine a completely self-contained unit. If ample air supply is available, this pump may be omitted (and price allowance made).

Electrical controls are complete for setting production cycles, and visible timers provide for a record of setting to be made. Maximum current draw is 23 amp., and line voltage of 220 v. is required, unless otherwise specified. All control wiring is 24 volts. Instrumentation includes line and tank air-pressure gages, vacuum gage, safety shut-off temperature indicator, and timing indicators for heat, vacuum, and air. The drape action has an adjustable speed control for both speed of drape and speed of release. Sheet hold-



ers are adjustable. *The Whitlock Co., 4737 Ravenswood Ave., Chicago 40, Ill.*

Hydraulic presses

A line of four-column hydraulic presses is built in a variety of platen sizes and strokes to suit customer specifications, from 25 to 100 tons. The presses are recommended by the manufacturer for trimming operations, compression-type molding, sheet metal forming, etc.

Daylight on these machines is adjustable, with the top platen rigidly supported between heavy-duty nuts which are fitted to the columns. An inching adjustment is incorporated in the top platen. A T-slotted bolster plate is supplied as standard equipment. The moving platen is drilled to suit the requirements of the customer.

The hydraulic unit is self-contained and is of the differential circuit type. It incorporates high- and low-pressure pumps. A double-shafted motor is used with a pump coupling at each end. The hydraulic cylinder is of the high-pressure type and is mounted directly to the moving platen by a flange unit. All components are standard and readily replaced when required.

The electrical system is interlocked with the hydraulic unit. Travel of moving platen is controlled by two limit switches. Any part or all of the cylinder stroke can be used. Push-buttons mounted just above the bolster plate are wired in series and the press will operate on the down-stroke only as long as they are depressed. *Paul Machine Tool & Die Works, 4600 S. Kedzie Ave., Chicago 32, Ill.*

Air pump

A reduction of 33% in over-all height and an increase in vacuum to as low as 0.4 mm. Hg. absolute is claimed for a line of straight-wing rotary air pumps ranging in capacity from 2.4 to 40 cu. ft./minute. These improvements are said to be the result of a more efficient automatic oiling system placed under the pump instead of at the top, as was the case with previous systems. This redesign did not involve changes in the length of steel wings, area of piston space, or efficiency of automatic wing adjusters in the pump itself.

When used for pressure, these pumps are said to provide a range of 15 to 20 p.s.i.g. *Leiman Bros., Inc., 102 Christie St., Newark 5, N. J.*

Heat splicer

This equipment is for use in processes where a new roll of film must be spliced to the end of a roll just finishing. It is a jaw-type splicer incorporating a Robertshaw-Fulton thermostat and a timer. The unit is attached by bolting it to the unwind end of a winding machine. Heating time recommended by the manufacturer is 6 to 8 sec., and the temperature is selected on the basis of the gage of the material being spliced. The machine is available in models handling materials up to 72 in. wide. *T & M Machine & Tool Co., 15 Greenpoint Ave., Brooklyn 22, N. Y.*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Books & Booklets

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"Cellulose and Cellulose Derivatives Part III"

Edited by Emil Ott, Harold M. Spurlin, and Mildred W. Grafflin

Published in 1955 by Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y. 544 pages. Price: $12.00.

Third of a three-part definitive treatment of cellulose and cellulosics, this volume is concerned with the physical properties of cellulose and its derivatives in solution, including solubility, thermodynamic properties of solutions of long-chain compounds, behavior of cellulose xanthate as a polyelectrolyte, determination of molecular weight and molecular weight distribution, theory of the viscosity of dilute solutions of long-chain compounds, and flow properties; mechanical properties, including behavior of cellulose substances, molecular and morphological considerations of extension, ultimate strength, and tests for cellulose and its derivatives. Finally, there are over 100 pages of appendices which include charts, tables, etc. Part II was reviewed in MODERN PLASTICS *32* 174, March 1955.

"Electrical Insulation and Dielectrics—1955"

Published in 1955 by The Gage Publishing Co., 1250 Sixth Ave., New York 20, N. Y. 130 pages. Price: $3.00.

Approaching the field of electrical insulation and dielectrics from the standpoint of the application of these materials in the design of all types of electrically energized equipment, this book presents a critical appraisal of property characteristics and applications possibilities.

Beginning with a chapter on research progress in dielectrics, discussions of many types of materials are given. Epoxy-resin systems, plastics insulation, glass-premix compounds, filled fluorocarbons, plastics laminates, and thermosetting laminates, are among the materials described. A chapter on European developments in the dielectrics field ends the book.

"Metal Finishing Guidebook, 1956 Edition"

Published in 1955 by Finishing Publications, Inc., 381 Broadway, Westwood, N. J. 606 pages. Price: $3.50.

The 24th annual edition of this book presents articles by various authorities in the field. Such topics as finishing plant engineering, mechanical surface preparation, chemical surface preparation, plating solutions and operating data, special plating procedures, special surface treatments, are covered. Tables and data sheets, a directory of suppliers and manufacturers, a list of trade names, a list of reference books, a list of metal finishing consultants, and a list of schools for electroplating are included.

"Chemical Engineering Catalog, 1955-56"

Published in 1955 by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 1917 pages. No charge in the United States and Canada if volume is returned when new edition is published. Price $12.50 for permanent purchase.

The 40th annual edition of this reference volume covering the chemical processing industries presents information on equipment, raw materials, chemicals, and supplies offered by over 500 participating companies, with most companies listing their entire applicable lines. Six indices provide ready cross-reference.

Electrostatic neutralizer. Technical Bulletin No. 126 describes electrostatic neutralizers, their principle of operation, advantages, and characteristic properties. How they are mounted on machinery and how they compare with other types of industrial neutralizers, such as high-voltage radioactive types, are also discussed. *Herman H. Sticht Co., Inc., 27 Park Pl., New York, N.Y.*

Acrylic emulsion paints. Acrylic paints, how they are made, how they differ from other paints, where they should be used, and what their future may be are discussed in folder entitled "Acrylic Emulsion Paints." *Rohm & Haas Co., Washington Square, Philadelphia 5, Pa.*

Conversion tables. Bulletin F7255 is a 16-page booklet which gives thermocouple temperature millivolt equivalents in tabular form. *Barber-Colman Co., Wheelco Instruments Div., Rockford, Ill.*

Oils and lubricants. Folder entitled "Houghton Serves the Plastics Industry," describes a line of hydraulic oils, lubricants, and packings. Advantages, characteristics, and properties are given. *E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.*

Painting machine. Brochure 601 describes stationary gun pressure contact automatic painting machine, designed for single color decorating of small and medium size parts. *Conforming Matrix Corp., 364 Factories Bldg., Toledo 2, Ohio.*

Buffing and polishing. Characteristics and uses of over 100 buffing and polishing compounds are described in Bulletin Co-103. Specific compounds are classified and described, with recommended usage, under the general headings of tripoli, cut and color compounds, steel and stainless steel buffing compounds, emery paste and cake, crocus, polishing lubricants, rouges, greaseless compounds, and special compounds. *Hanson-Van Winkle-Munning Co., Matawan, N. J.*

Cast acrylic. Sizes, thicknesses, weights, and specifications of a line of acrylic sheets, rods, and tubes are given in six specifica-

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tion sheets entitled "Plexiglas 'R' Grade." *Cadillac Plastic & Chemical Co., 15111 Second Ave., Detroit 3, Mich.*

Epichlorohydrin. An 8-page bulletin, F8862, describes physical properties, applications, typical reactions, and physiological properties of epichlorohydrin, a raw material for epoxy resins, ion-exchange resins, surface active agents, pharmaceuticals, and dyestuffs. *Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*

Pipe, tubing, etc. Properties, specifications, sizes, and characteristics of a line of corrosion-resistant pipe, tubing, ducting, valves, and fittings are presented in Bulletin 51155. *American Agile Corp., P. O. Box 168, Bedford, Ohio.*

AEC reports. A monthly publication, "U.S. Government Research Reports," lists recent reports of research by the Atomic Energy Commission covering many areas of scientific and industrial interest including chemistry, geology, metallurgy, minerology, ceramics, instrumentation, physics, and reactor technology. In addition, each issue describes over 300 reports of research released by the Army, Navy, Air Force, and certain civilian agencies. $6.00 a year, $3.00 additional for foreign mailing. *Supt. of Documents, U. S. Government Printing Office, Washington 25, D. C.*

PVC pipe. Pamphlet PE-40 describes properties, sizes, uses, and dimensions of a line of polyvinyl chloride pipe and fittings. Installation instructions are offered. *Plant Equipment Sales, Corning Glass Works, Corning, N. Y.*

Non-metallics for pump impellers. Physical and chemical characteristics of non-metallic impellers for displacement pumps are presented in this four-page folder. Synthetic elastomers, fluorocarbons, and resinous laminates are surveyed and the influences on them of chemicals and mechanical and thermal stresses are reviewed. In addition, applications of positive displacement pumps which are using non-metallic impellers suited to particular chemical handling problems are described. *Eco Engineering Co., 12 New York Ave., Newark, N. J.*

Chemicals. A six-page bulletin, C197R, describes characteristics and uses of a line of chemicals and other products derived from tin, antimony, and zirconium. *Metal & Thermit Corp., 100 E. 42nd St., New York 17, N. Y.*

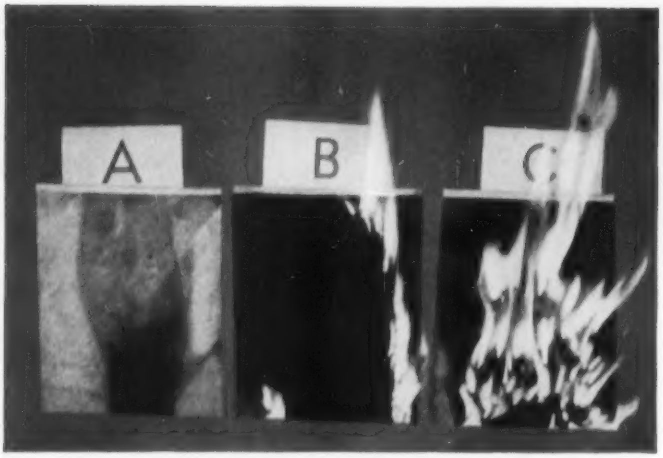
Diisocyanates. Bulletin I-17 lists generic properties, data on 27 basic reactions common to all diisocyanates, suggested uses, and references. Five supplementary bulletins give specific technical data on specific diisocyanates. *National Aniline Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.*

Cold cleaners. Properties, advantages, and uses of a line of cold

(To page 192)

the flame test

that's pointing the way to new products



FLAME RETARDANCY TEST. 3 lacquers were formulated using same basic formula with exception of plasticizer. In Case A, it was Celluflex CEF; Case B, tricresyl phosphate; Case C, dibutyl phthalate.

Lacquers were sprayed on panels, then ignited for 7 seconds. Upon removal of flame, Panels B and C continued to burn but Panel A (Celluflex CEF lacquer) extinguished itself within 2 seconds!

Dr. Christopher Wilson,
Director of Research,
Hudson Foam Plastics Corp.,
Yonkers, New York

"CELLUFLEX CEF is the best all-round flame-retardant . . ." — Dr. Wilson

"Of all the flame retardants we have tried, Celluflex CEF is the easiest to use. It provides more retardance per pound—an important point when you consider that the less additive you need the less possible adverse effect on other properties in the polyester foam. In economy of use, availability and effectiveness, Celluflex CEF is by far the best all-round flame retardant we have evaluated."

...CUSH-N-FOAM,* for example...

CELLUFLEX* CEF builds fire resistance into Hudson's new polyester foam

Hudson Foam Plastics Corp. predicts a brilliant future for its new polyester foam. Cush-N-Foam is fire resistant . . . burns only in the presence of a flame. Remove the flame, and the fire goes out. Independent tests also show that it has twice the cushioning resistance, four times the tensile strength of foam rubber. Cush-N-Foam is virtually unaffected by oils, perspiration, most cleaning solvents . . . doesn't decompose or shred. It's odorless, washable in soap and water. It can be sewed on an ordinary sewing machine, heat-sealed to other plastics.

Celluflex CEF (trichloroethyl phosphate) is being used by manufacturers of a wide variety of plastics and surface coatings—cellulosics, vinyls, polyesters, polyurethanes.

Developed by Celanese research, this new plasticizer offers more flame retardancy per pound, excellent chemical stability, low temperature properties, ultraviolet light stability, and a water-white color clear enough for transparent coatings. Evaluate Celluflex CEF in your own product. For test samples and complete technical data, please write to Celanese Corporation of America, Chemical Division, Dept. 577-C 180 Madison Avenue, New York 16, N. Y.

CHEMICAL PROGRESS WEEK APRIL 23-28

For a given compression resistance, Cush-N-Foam has only half the weight of foam rubber...makes possible mattresses of half the present thickness. Cush-N-Foam has been approved and is being used and specified by leading manufacturers of aircraft, bedding, furniture and carpet cushioning, shoe insoles, packaging, insulation, acoustics and gasketing materials.

Celanese* CHEMICALS

*Reg. U. S. Pat. Off.

cleaners for metals are presented in properties chart entitled "Manpro Cold Cleaners." *Manufacturers Processing Co., 1360 Hilton Rd., Detroit 20, Mich.*

Plastics threader. Brochure describes a portable machine which cuts threads in any plastic on a production basis to class 3 tolerance. Advantages, methods of use, and specifications are included. *Gould Machine Tools, Inc., P. O. Box 103, Westville, N. J.*

Package testing. Booklet No. 11 offers a check-list by which to judge the protective qualities and general efficiency of specific corrugated boxes. *Hinde & Dauch Paper Co., Sandusky, Ohio.*

Pipe fabrication. Brochure pictorially describes operations in fabrication and erection of low- and high-pressure piping, ranging from pneumatic control panel systems to large hydraulic presses. *Mercury Piping Co., Bldg. 23, Endicott St., Norwood, Mass.*

Tumbling equipment. Catalog presents a line of tumbling-finishing equipment. Specifications, prices, advantages, availability, etc., of such items as portable tumbler-mixers, attachable barrels, barrel finishers, etc., are given. *Rampe Mfg. Co., 14915 Woodworth Ave., Cleveland 10, Ohio.*

Vacuum forming. Entitled "Concepts that Count in Vacuum Forming," this four-page folder describes a method of forming thermoplastic sheet by a combination of heat and vacuum, describes facilities available, and gives illustrations of typical products. *Nordic Plastics Co., Inc., 383 Douglass St., Brooklyn 17, N. Y.*

Building and etching. National Bureau of Standards' 36-page circular 565 describes two methods for making precise graduated circles for theodolites—graduations engine-ruled in a wax resist that has been coated on the glass circle and graduations by etching in light-sensitive resist coated on the contest-exposed circle. Disadvantage, advantages, etc., are dis-

cussed. 30¢. *U. S. Government Printing Office, Washington 25, D. C.*

Fibrous glass. Technical data folder entitled "Fiberglas Reinforced Molding Compounds" presents a list of manufacturers of these products, case histories of current applications, and specification sheets describing several types of currently available materials. An explanation of what fibrous glass-reinforced molding compounds are, what they are used for, and how they are used is given. *Owens-Corning Fiberglas Corp., 598 Madison Ave., New York 22, N. Y.*

Stock nozzles. Engineering specification sheet gives model numbers, make of heater, thread size and type, rear opening, radius, stock openings by 16ths, and prices for a line of nozzles for injection molding machines. *Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, Ohio.*

Instruments for industry. Pyrometers, thermometers, thermocouples, air velocity meters, dewpoint indicators are some of the instruments which comprise a line of instruments described in booklet entitled "Precision Instruments for Industry." In addition, the number of a bulletin which gives complete engineering data for each instrument is given. *Illinois Testing Laboratories, Inc., 420 N. La Salle St., Chicago 10, Ill.*

Silicone. A 12-page 1956 reference guide describes almost 150 of the most generally used silicone products, 18 of which were first introduced within the last 12 months. The products are grouped by physical form (fluids, compounds, greases, resins, and rubbers) and cross-indexed by usage (dielectrics, defoamers, damping media, etc.). Charts, tables, and graphs showing properties are included. *Dow Corning Corp., Midland, Mich.*

Sugarcane bagasse. Eighty-three-page Marketing Research Report No. 95 discusses the possible utilization of bagasse, the fibrous portion of sugarcane left

after the extraction of the sucrose-containing juice, as a raw material for commercial products. Physical characteristics, production, availability, cost as a raw material, market potentials for present and possible bagasse products, etc., are covered. 45¢. *Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C.*

Mylar. Booklet MB-4 describes latest commercial uses and physical and chemical properties of Mylar polyester film. Advantages, availability, and specifications are included. *E. I. du Pont de Nemours & Co., Inc., Film Dept., Wilmington 98, Del.*

Metallic stearates. A 36-page bulletin, No. 55-2, describes the properties and uses of metallic stearates, shows the industries in which they are used, and presents an analysis of recommended applications. *Witco Chemical Co., 122 E. 42nd St., New York 17, N. Y.*

Adsorption. Report PB 111701 contains experimental results which indicate that the amount of adsorption in polyvinyl acetate and polyvinyl butyral wash primers is a function of molecular weight. Also discussed is the general function of the resin in the wash primer and as an assistant for corrosion protection. $1.25. *OTS, U. S. Dept. of Commerce, Washington 25, D. C.*

Industrial radiography. Bulletin P-196 describes projectors for industrial radiography with gamma rays. Types of radiographs that can be made, advantages of the equipment, and available accessory equipment are discussed. *Metal & Thermit Corp., 100 E. 42nd St., New York 17, N. Y.*

Organic chemicals. Revised Booklet F-6136 presents data on more than 350 organic chemicals. The products are arranged by related groups with condensed data on applications. Properties are given in tabular form, and an alphabetical index is included. *Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*

mp Plastics

Production and sales figures in pounds* for October and November 1955

Materials	*Total p'd'n first 11 mos. 1955*	*Total sales first 11 mos. 1955*
Cellulose plastics:[a]		
Cellulose acetate and mixed ester		
Sheet, under 0.003 gage	17,043,998	17,383,460
Sheets, 0.003 gage and over	14,167,331	13,742,734
All other sheets, rods, tubes	7,049,932	6,631,774
Molding, extrusion materials	84,011,521	82,611,566
Nitrocellulose sheets, rods, tubes	4,441,183	4,636,423
Other cellulose plastics	5,436,224	5,037,957
Phenolic and other tar-acid resins:		
Molding materials[a]	192,715,050	179,407,951
Bonding and adhesive resins for:		
Laminating (except plywood)	59,474,964	46,783,580
Coated and bonded abrasives	40,322,002	31,424,726
Friction materials (brake linings, clutch facings, etc.)	23,404,233	21,100,728
Thermal insulation	46,615,718	46,939,210
Plywood	37,115,645	30,225,720
All other bonding uses	21,909,527	21,509,196
Protective-coating resins	24,318,626	22,957,223
Resins for all other uses	33,871,995	29,801,259
Urea and melamine resins:		
Textile-treating resins	38,293,130	37,143,800
Paper-treating resins	20,792,267	19,635,822
Bonding and adhesive resins for:		
Plywood	89,183,987	84,643,476
All other bonding and adhesive uses, including laminating	26,008,045	25,525,189
Protective-coating resins	35,259,670	27,426,556
Resins for all other uses, including molding	76,136,260	74,006,974
Styrene resins:		
Molding materials[a]	381,509,184	350,503,514
Protective-coating resins	92,007,693	84,839,015
Resins for all other uses	86,470,184	77,276,774
Vinyl resins, total[b]	636,798,379	601,248,114
Polyvinyl chloride and copolymer resins (50% or more polyvinyl chloride) for:		
Film (resin content)		77,004,559
Sheeting (resin content)		46,838,629
Molding and extrusion (resin content)		167,054,563
Textile and paper treating and coating (resin content)[c]		59,120,857
Flooring (resin content)		52,142,269
Protective coatings (resin content)		25,459,307
All other uses (resin content)		49,447,352
All other vinyl resins for:		
Adhesives (resin content)		29,617,994
All other uses (resin content)		98,562,583
Coumarone-indene and petroleum polymer resin:	239,740,263	238,522,742
Polyester resins:		
For reinforced plastics	46,144,089	39,843,616
For all other uses	3,133,745	2,981,335
Polyethylene resins:		
Miscellaneous:		
Molding materials[a, d]	131,143,227	102,025,941
Protective coating resins[e]	4,055,877	2,427,977
Resins for all other uses[f]	90,028,402	88,700,971

* Dry basis designated unless otherwise specified.
** Partially estimated. † Revised.
[a] Includes fillers, plasticizers, and extenders. [b] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production are given. [c] Includes

Production

From statistics compiled by
the U. S. Tariff Commission

October**		November**	
Production	Sales	Production	Sales
1,659,842	1,718,955	1,374,123	1,673,413
1,508,321	1,525,509	1,511,326	1,428,203
711,619	665,928	609,915	648,746
8,373,816	8,130,545	8,394,060	8,730,489
415,240	428,007	451,304	484,404
384,727	433,674	642,969	616,466
19,469,839	18,049,178	19,122,245	17,979,534
6,356,997	4,723,738	6,143,979	4,708,612
1,429,789	1,434,465	1,364,209	1,547,468
2,238,093	1,797,646	2,211,229	1,978,137
5,191,523	5,067,218	5,124,975	5,308,691
3,669,924	3,018,721	3,992,141	3,242,251
3,050,264	2,545,135	3,033,871	3,021,443
2,462,926	2,054,933	2,492,856	2,187,316
3,212,845	2,300,398	3,670,563	2,893,882
†3,987,215	†3,988,840	4,049,269	3,975,455
2,462,635	2,162,067	2,067,965	1,618,217
8,579,538	8,349,510	8,651,944	8,090,290
2,896,102	2,590,039	2,417,609	2,365,180
3,436,995	2,885,855	3,522,960	2,837,003
8,572,810	7,704,891	8,010,403	7,444,906
40,179,800	38,050,603	40,081,328	36,256,231
†8,799,833	†7,946,001	9,288,551	7,951,862
†8,280,062	8,017,724	8,190,607	8,096,659
62,159,385	†60,672,011	62,199,548	62,806,065
	†7,498,327		6,855,426
	†4,580,639		4,771,308
	†16,066,801		18,223,569
	6,043,032		6,271,048
	†5,368,677		4,944,752
	†2,290,289		2,146,625
	†6,318,381		6,817,738
	2,669,976		2,944,785
	9,835,889		9,830,814
23,471,156	22,971,739	23,211,850	22,835,355
3,630,604	3,312,141	4,080,086	3,963,140
231,194	100,948	361,717	397,204
39,208,150	34,616,537	40,911,329	35,630,762
4,857,554	4,443,228	4,928,198	4,449,268
351,711	194,076	341,261	215,656
8,025,279	7,326,799	7,635,285	7,355,858

data for spreader and calendering-type resins. d Includes data for acrylic, polyethylene, nylon, and other molding materials. e Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective-coating resins. f Includes data for acrylic rosin modifications, nylon, silicone, polyethylene, and other plastics and resins for miscellaneous uses.

Plastics house competition

To stimulate a greater awareness and appreciation of the possibilities which plastics offer in modern home construction, a competition is now being conducted by The Society of the Plastics Industry, Inc., for the best design of a medium-priced home in which plastics materials are used to fullest advantage. The contest is open to any architect, designer, draftsman, or student in a recognized school of architecture. It has also been approved by the Committee on Architectural Competitions of the American Institute of Architects and Institute members are therefore permitted to enter.

The problem to be faced by prospective participants in the competition is the design of a one-story, basement-less house no larger than 1600 sq. ft. in floor area. Areas used for garage, carport, or covered porch will not be included within the house area itself.

With this as his basic problem, the designer can feature the use of plastics in the house, equipment, fixtures, or structural elements in any manner he chooses. However, plastics should only be used to best capitalize on their physical characteristics, such as: strength properties; ease of cleaning; resistance to tarnishing; low maintenance and replacement costs; formability; good weatherability; appearance despite hard wear; beauty of color and texture; freedom from odor, taste, and toxicity; and light weight. Ideas for new uses of plastics that will provide increased livability, comfort, safety, and value in residence construction are the ultimate objectives which are being sought.

More specifically, the purpose of the competition is to broaden the application of plastics in a manner that will permit savings both in material and in construction costs.

The rules of the competition further stipulate that the following major spaces be included in the house: living room, kitchen, bedrooms, family room, dining room, bathroom, and garage or carport with space for two cars. In addition, adequate storage must be provided for each major area and a general storage area in a central location or in the garage or carport.

One or more of the following feature areas of the house should be designed to feature the use of plastics: porch or outdoor living area; kitchen and/or breakfast area; bath and/or dressing room; and playroom. The plastics equipment, fixtures, or structural elements included in these areas will be evaluated not only on their use as shown, but on their flexibility of use in other houses and in other compositions. Moreover, the use of plastics in these feature areas in a manner which fully exploits the esthetic, functional, and economic possibilities of the materials will outweigh excellence in design.

Prospective entrants in the competition can receive information and application forms from James T. Lendrum, A.I.A., professional adviser, S.P.I. Plastics House Competition, Mumford House, Univ. of Illinois, Urbana, Ill. Submissions of designs must be shipped with charges prepaid to Mr. Lendrum no later than 5 P.M., May 20, 1956. The jury, which consists of Hiram McCann, editor of Modern Plastics Magazine, Paul M. Rudolph, architect, and John N. Highland, architect, will begin deliberations on or about May 29, 1956. Drawings received after this time will not be considered.

Prizes will be awarded as follows: grand prize for the best house utilizing plastics, $1000; second prize, $500; third prize, $250; and honorable mention, $100. For each feature area (porch, kitchen, bathroom, playroom) showing best utilization of plastics, first and second prizes of $250 and $100, respectively, will be awarded.

Prizes will be presented to the winners during the Seventh National Plastics Exposition sponsored by S.P.I. which is to be held in New York City during the week of June 11 through 15, 1956.

Better than rubber

Polyethylene has replaced rubber for the slotted tubes which encase the active material and grid spines of the positive plates of all Exide-Ironclad industrial batteries. Exide scientists expect this change-over to result in an increase of 20% in battery working life at full rated capacity.

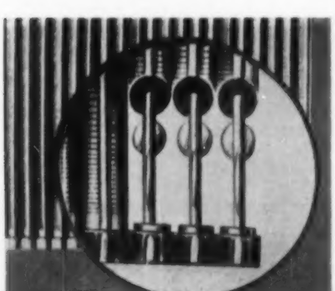
When rubber tubes were used, corrosive action within the cells caused the slots in the tube to gradually increase in size. Thus, the slots originally had to be made smaller than desired so that they would not become too large too soon. Because of this, the active material could not be penetrated freely by the electrolyte during the first part of the battery life and hence full capacity was not available until after the battery was placed in service.

Since polyethylene is not affected by the corrosive action, the slots can be made the correct size at the very beginning—in fact, the polyethylene tubes can be slotted to provide greater porosity than with rubber—and the batteries can give higher initial capacity.

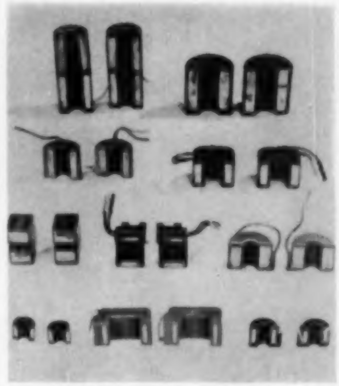
Because polyethylene is translucent, it was possible for Exide to introduce a new manufacturing control in the form of a visual inspection procedure to further assure complete filling of every tube with active material.

Tube sealers of the same plastic, attached snugly to the bottom of the slotted tubes, seal in the active material and prevent short circuits.

Credits: Polyethylene supplied by Bakelite Co. and E. I. du Pont de Nemours & Co., Inc.



Cross-section of battery showing polyethylene tubes



Sections of coils potted for precision applications

Coils in epoxy

Imbedding sensitive electrical coils in moisture-resistant casings made of epoxy resins helps to maintain operations under extreme conditions of abuse. Such protective shells will withstand exposure to cutting oils and acids as well as such hazards as flying chips, dust, and extensive vibration in high speed machinery.

Engineered for applications involving extreme moisture conditions such as in water pumps, defrosting valves for refrigerators, and air conditioning equipment where condensation is an ever-present problem, the epoxy compound is molded around the coil and penetrates between the precision windings.

Approved by Underwriters' Laboratories as a Class A insulating material, the durable coil potting material has excellent stability, low shrinkage, and low cure temperature. Such epoxy compounds also adhere to most surfaces, including other plastics as well as metal, glass, rubber, wood, and ceramic.

Designed to resist shock, vibration, and wide ranges of temperature, these potted coils are also used in automation systems, motor contactor coils for mining machine compressors, telemetering systems controlling pump stations, magnetic motor starters, and other precision applications.

Credits: Based on Bakelite epoxy resins, Luxolene molded coils are produced by Deluxe Coils, Inc., First and Webster Sts., Wabash, Ind.

Decorative vinyl coverings

Having recognized the fabulous market potential existing for protective vinyl coverings in the residential home field (see "Big Market—Big Challenge," MODERN PLASTICS 33, p. 85, Oct. 1955), the manufacturers of such coverings are now devoting considerable time to supplementing the functional advantages of the vinyl materials with exciting new textures and patterns that harmonize with current interior decoration trends.

Typifying the quality jobs being done by manufacturers along these lines are the high-style offerings of two of the recent entrants to the field of vinyl wall coverings—Velveray Corp., New York, N. Y., and Stix Products, Inc., Div. of Vivitex Corp., New York, N. Y.

The Velveray wall covering, known as Velvetex, is made up of vinyl film fused to a fabric backing and printed with special vinyl inks that contribute to serviceability and washability. Velvetex is supplied in rolls 24 in. wide, pretrimmed, and precision matched. It can be hung with any ordinary wallpaper paste.

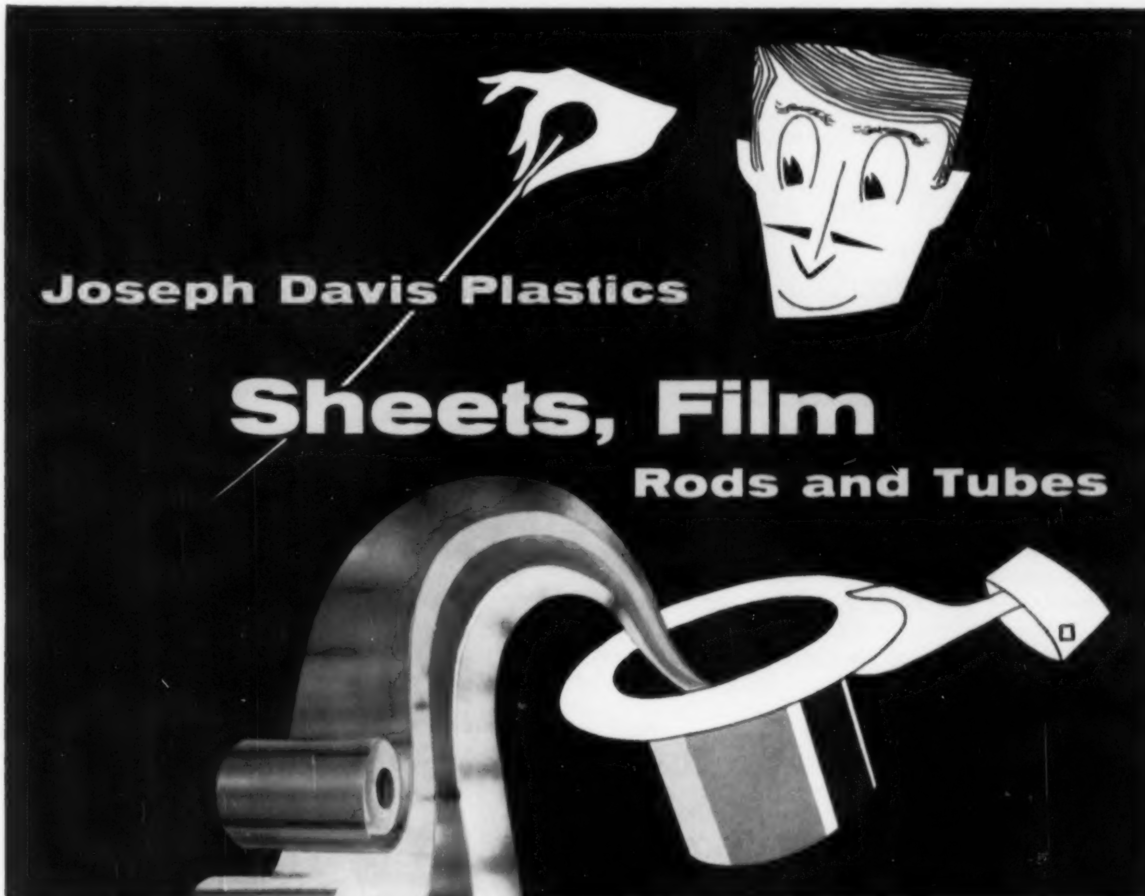
In line with the most current of home decoration trends, over one-third of the patterns in the company's collection (which spans 16 different designs in from three to six colors, nine embossed tints, and a linen design in 11 colors), is devoted to textures or designs suggestive of texture. Included in this category are brick, thatching, mosaic, stone, and a wood strip pattern. The linen-type coverings and the tints, which are embossed with a pebble-like surface, complete the texture group. The other designs in the company's line embrace a wide range of subjects—from Parisian night scenes to exotic sea shells.

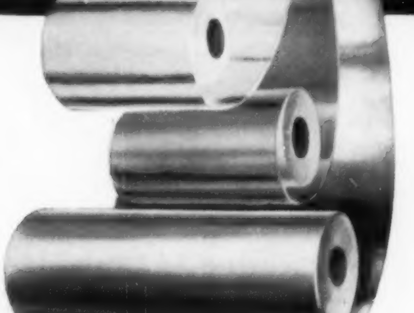
The Stix material is made up of unsupported vinyl film backed with a pressure-sensitive adhesive that facilitates do-it-yourself application to walls, furniture, lamps, etc. It is currently packaged in 5-yd. and 10-yd. rolls, but will also eventually be merchandised in precut, prepackaged form for such specialized applications as bridge table coverings, shelf and edge coverings for linen closets, etc. The adhesive coating is protected with a removable paper backing, marked for easy cutting.

Based on a specially formulated Velon vinyl film supplied by Firestone Plastic Co., Stix is available in 36 different design and color combinations, including abstract leaf prints, gingham plaids, stripes, and the ever-present texture patterns (marble, wood grains, and a nubby texture print that provides a tweed-like effect). An unusual innovation in the Stix line is "Cedar-Odor," a covering for cabinets which not only has the pattern and color of cedar but, interestingly enough, is impregnated with the scent of the wood itself.

Lamp base covered with self-adherent vinyl sheet

Supported vinyl sheet makes attractive wall covering





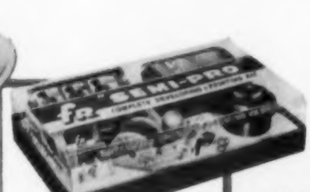
CELLULOSE ACETATE • HI-IMPACT STYRENE

Transparent, Translucent, Opaque . .
suitable for vacuum forming . .
light-to-heavy gauges.

JODA EXTRUDED CELLULOSE ACETATE SHEETS, ROLLS AND FILM declared to be best quality on the market . . . the result of a survey conducted by one of the largest chemical manufacturers in America.

Party hats vacuum formed of flame retardent JODA ACETATE in 6 brilliant colors by

FANCHON CO.
New York City



Cover for photography kit manufactured from clear transparent JODA ACETATE

ACETATE BOX CORP.
Brooklyn, N. Y.

Sales Representatives Conveniently Located

JOSEPH DAVIS PLASTICS COMPANY

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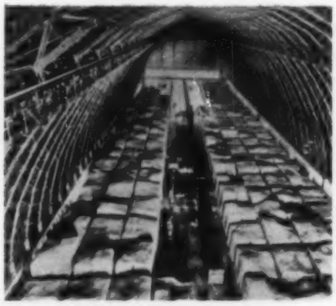


Polyethylene sheets protect stored bags of rice

Rice protection

An ingenious use of polyethylene film has solved the problem of protecting some 120,000,000 lb. of rice from dirt and deterioration while in storage. If unprotected, the rice, which is stored in a massive blimp hangar 1000 ft. long, 360 ft. wide, and 200 ft. high, would be subject to attack by insects as well as spoilage by water and dirt.

Preparation of the rice for storage involves two principal operations: putting it in bags holding 100 lb. each; and covering stacks of filled bags with huge sheets of polyethylene film.

The bulk rice from boxcars falls into a track hopper, is then elevated to a scale hopper and automatically weighed and bagged. The bags are mechanically stacked in piles holding the contents of four boxcars—400,000 lb. of rice in 4000 bags. Sheets of polyethylene film 3 mils thick and measuring 64 by 66 ft. are put over each stack and anchored to the floor on all four sides by 6-ft. long polyethylene tubes each filled with 25 lb. of sand.

Fumigation is carried out with the polyethylene tarpaulins in place by means of a gas tube. Warehouse operators say that the sheeting permits fumigation at an extremely low cost and prevents reinfestation by stray insects. It also gives protection against roof leaks, birds, dust, and soot.

Credits: Visqueen polyethylene film is produced by the Visking Corp., Plastics Div., Chicago, Ill.; tarpaulins are fabricated and distributed by H. T. McGill, Houston, Texas.

Package is air pillow

An ingenious swim trunk package, fabricated of transparent vinyl sheet stock, is an excellent example of the re-use possibilities inherent in plastics packages. It not only carries the dry swim trunks—plus any accessories you may care to tuck in—safely and neatly to the shore, and brings the wet trunks back without soaking clothes or seats of cars, but the pouch may be easily inflated into an air pillow to provide greater comfort and relaxation on the sand.

To fabricate the package, two sheets of vinyl are first heat-sealed at all four outer edges to form a pillow-type pouch. A conventional disk-shaped valve assembly and blow stem is "welded" into one wall of the pouch. A separate open-end pocket consisting of 4-mil vinyl is then heat sealed to the inner side of the pouch for merchandising display and for carrying the trunks. Selling copy is gold-stamped on the surface of the packet.

Credits: Produced for Manhattan Shirt Co., New York, N.Y., vinyl Pillow-Pak is supplied by Prepac Inc., 151 W. 26th St., New York, N.Y.

Handy vinyl package for swim suit doubles as inflatable beach pillow. Pocket, blow stem, and valve are all heat-sealed to pouch

Bearing caps

Molded polyethylene caps, no bigger than a thumb-tip, are being used to prolong the life of bearings and bushings. Resistant to greases, lubricating oils, paints, transmission fluids, and water, the caps prevent dirt, grit, and water from getting into high-pressure grease fittings.

These tight-fitting polyethylene caps, which have the toughness and resilience to protect fittings from nicks or burrs, were rigorously tested by various branches of the U. S. Navy and Marine Corps. Conducted in the laboratory, as well as on naval gun mounts, combat vehicles, dump trucks, and amphibian tractors, the tests determined that over a temperature range of from −40 to 200° F., on wet or dry dirt roads, through water and off-the-road conditions, the durable caps successfully sealed out foreign matter from openings in vital grease fittings.

The polyethylene caps also provide protection for grease fittings during painting, sandblasting, assembling, or storing of equipment, and may be re-used indefinitely because of their resistance to the various greases and oils with which they come in contact. In addition, the caps are molded in various colors, thus improving lubricating procedures and maintenance control through easy identification.

Credits: Pro-Caps are molded by YBF Corp., Warner Bldg., Washington 4, D. C., of Bakelite polyethylene.

Polyethylene caps protect bearings and bushings

Reorders prove...**DOLLAR for DOLLAR**

you get *More* with FELLOWS Molding Machines

Leading molding shops coast-to-coast use Fellows Injection Molding Machines because they know they can depend upon Fellows machines to deliver high level performance week after week...year after year. They prove their faith in Fellows superiority by ordering Fellows equipment when they expand – the greatest testimonial to the opportunity for more profits with Fellows.

Get the whole story from the Plastics machine specialist in any Fellows office. It can mean money in your pocket!

More PRODUCTIVITY

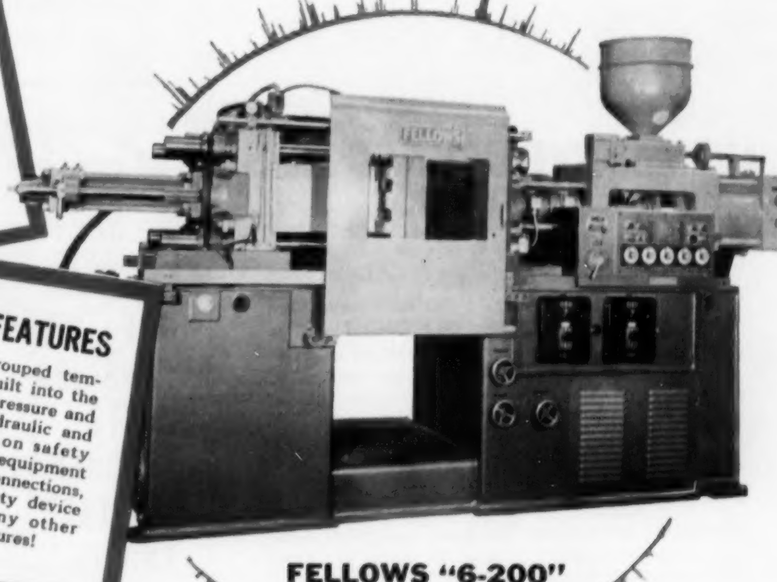
with tight production schedules the "6-200" is the fastest automatic FULL 6 OUNCE machine on the market! Fully automatic feature allows one man to operate 3 or more machines. Speed-Flo heating cylinder delivers "dry-run" speeds from 490 to 650 cycles per hour.

More VERSATILITY

"pre-pack and pre-position" device—optional on the "6-200"—brings plunger halfway forward during press dwell, providing up to 8 OUNCE "SHOTS". The "6-200" takes 12" x 24" molds horizontal, 15" x 21" vertical, 8" x 14" thick.

More PLUS FEATURES

the "6-200" has grouped temperature controls built into the machine, injection pressure and speed controls...hydraulic and electric interlocks on safety doors...and as extra equipment – counter air blast connections, alarm timer and safety device for mold...plus many other Fellows exclusive features!



FELLOWS "6-200"

Fellows

injection molding equipment

THE FELLOWS GEAR SHAPER COMPANY, Plastics Machine Division, Head Office and Export Department, Springfield, Vermont
Branch Offices: 319 Fisher Building, Detroit 2 • 5835 West North Avenue, Chicago 39 • 2206 Empire State Building, New York 1
6214 West Manchester Avenue, Los Angeles 45

Automotive

(From pp. 89-94)

the fender and fin. The reinforced plastics instrument panels used on a number of the new Studebaker models, are molded of fibrous glass-polyester laminate and require no supplementary finish over the integral black color in which they are produced, although some are padded at the top. Dial faces and other elements of the panel are located in a decorative metal background which is mounted in the panel.

Top covers, body moldings

On its swank Eldorado models, Cadillac is continuing to make use of a reinforced plastic cover to protect the fabric top when it is folded back. This attractive cover, designed so that it conforms to the advanced styling of the Eldorado body, is finished to match the color of the car and is held in position by easily operated metal latches. Made in three sections, the U-shaped cover is easily removed and disassembled for convenient storage in the trunk compartment of the car.

The use of wood-grained fibrous glass body moldings on station wagon models—a practice followed for some time by several manufacturers—is now found on the new Ford eight-passenger Country Squire models, where the moldings are employed in conjunction with mahogany finished metal panels. This type of application has eliminated the old problem of discoloration, weathering, and rotting of wooden moldings.

In trucks

Specialized types of truck bodies are proving to be a growing market for reinforced plastics. One of the most notable examples of this trend is Chevrolet's highly styled Cameo Carrier, a new idea in the commercial carrier field. Reinforced plastics parts included on this truck include two support-fillers, the side panels which impart the smooth flow of lines from the cab rearward, the end gate panel, and the spare tire compartment. In addition to creation of a smart design, the plas-

tics panels of the Cameo Carrier effect considerable saving in weight without sacrificing strength. The six plastic parts weigh only 80 lb., or 40% less than similar parts in steel.

As an interesting sidelight, Chevrolet has now set up an extensive program under which these materials are being used in repairing regular sheet metal bodies.

International Harvester Co.'s motor truck division is utilizing fibrous glass-reinforced plastics, along with aluminum alloy and magnesium alloy, to achieve reduction of weight, increased payload, and corrosion resistance in its new Metro-Lite body, developed specifically for multi-stop retail delivery operations. According to R. M. Buzard, manager of sales for the division, the combined body and chassis weight of the new lightweight unit is approximately 15% less than a vehicle with similar chassis mounting the standard all-steel Metro body. Because of the light weight of the materials used, the bodies afford added capacity without increasing the wheelbase or outside width of the vehicles.

In the new Metro-Lite bodies, produced by Metropolitan Body Co., a Harvester subsidiary, the reinforced plastics panels are used for the front and rear roof caps and the front quarter panels, including the windshield frame. Another large manufacturer of trucks plans to make use of reinforced plastics in an engine cover for a cab-over-engine model truck slated to make its appearance early this year.

Reinformed plastics are also finding their way into the famous Willys Jeep, where they promise to contribute even greater durability and utility to this popular multi-purpose vehicle. For its new two-wheel drive Jeep Dispatcher, said to be America's lowest priced delivery vehicle, Willys now offers a hardtop model having steel body sides and a weatherproof molded polyester-glass top. Measuring approximately 65 by 70 by 7 in. deep, the top weighs approximately 32 lb. and is pigmented white, giving it a slight translucence. Construction features of the top include an integrally molded drip rail around the edge and full internal crossribs spaced on 6-in. centers. This durable new top not only fits current production models but may also be used on Jeeps already on the road.

Although less apparent to the casual observer than fibrous glass mat- and preform-reinforced automotive components such as exterior body parts, other functional units molded of sisal-polyester or glass-polyester premix-type materials are also emerging as an important new automotive outlet for plastics. The largest volume applications currently in use by this industry involve housings and related components for the newer-type automotive heating and air conditioning installations.

Sisal-reinforced polyester, lower in strength but also less expensive than glass-reinforced premix, has come into big volume use for certain types of automotive components where its strength is ade-

quate. In some instances, both glass and sisal are combined in the premix to provide a balance between cost and performance.

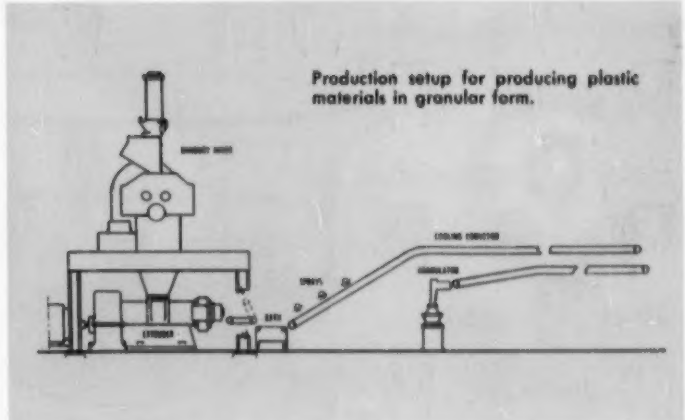
Molded heater housings now widely used on Chrysler cars as well as by other manufacturers have enjoyed a production run well into the millions of units and are found on many of the 1956 cars. By molding these housings in two parts of reinforced plastics (polyester-glass-sisal), high costs associated with the assembly of metal stampings are eliminated. Earlier, the same type of material was successfully employed in the fabrication of automotive heater ducts. Large components molded of the same type of premix material are also now widely used on some of the new automotive air conditioning systems, in which all components are localized within the engine compartment and on the dashboard assembly, taking up no space in the trunk. Some of these typical heating and air conditioning installations, including the housings and associated parts located on both sides of the firewall, involve as much as 10 lb. of the reinforced plastics material.

Components of this type offer a number of advantages over comparable stamped metal parts, such as lower die cost and finished part cost, corrosion resistance, elimination of costly assembly operations, and integral color. Parts having complicated contours are easily obtained with this type of molding and large components may be handled satisfactorily on presses having sufficient platen area. These materials have excellent thermal and acoustical properties and are not adversely affected by grease, oil, and other agents to which they are exposed in the engine compartment.

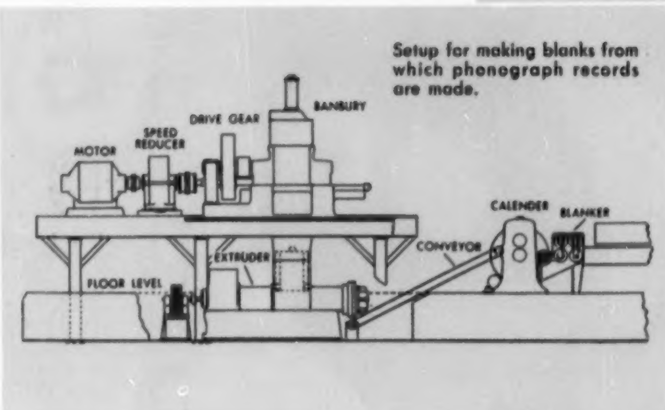
Plastic foams

History may record 1956 as the year when automotive manufacturers began to take a firm stand against wholesale slaughter on the nation's highways. With automobiles accounting for the deaths of well over 30,000 persons annually, plus hundreds of thousands injured, positive steps are now being taken by the industry (*to page* 218)

F-B MATCHED PRODUCTION UNITS



Production setup for producing plastic materials in granular form.



Setup for making blanks from which phonograph records are made.

EFFICIENCY UP-COSTS DOWN

As much of the processing equipment manufactured by Farrel-Birmingham normally operates in sequence, the company maintains an Engineering Planning Division, for the development of complete production layouts.

The processing setups diagrammed above are typical of the work performed by this division. Each layout is composed of production machines matched in capacity to prevent "choking" or "starving" of succeeding units. Production flows without costly interruption. Manual aid and supervision are cut to a minimum.

Farrel-Birmingham designs these layouts to meet widely varying physical and economic requirements. Our engineers will work with your engineers to help you select the right system for your needs.

Send for details of processing setups, and ask for information about any of the production units listed below.

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Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

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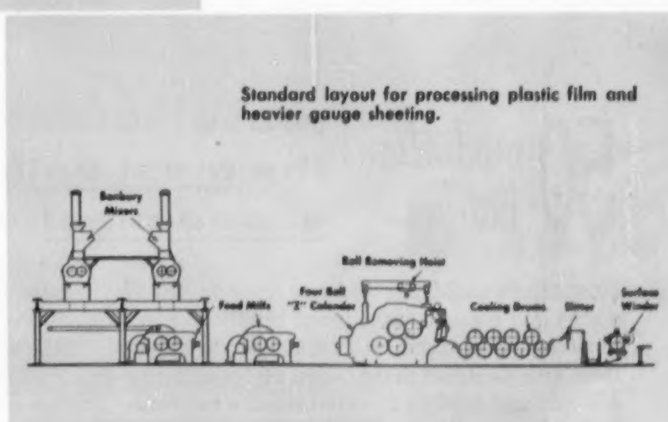


Standard layout for processing plastic film and heavier gauge sheeting.

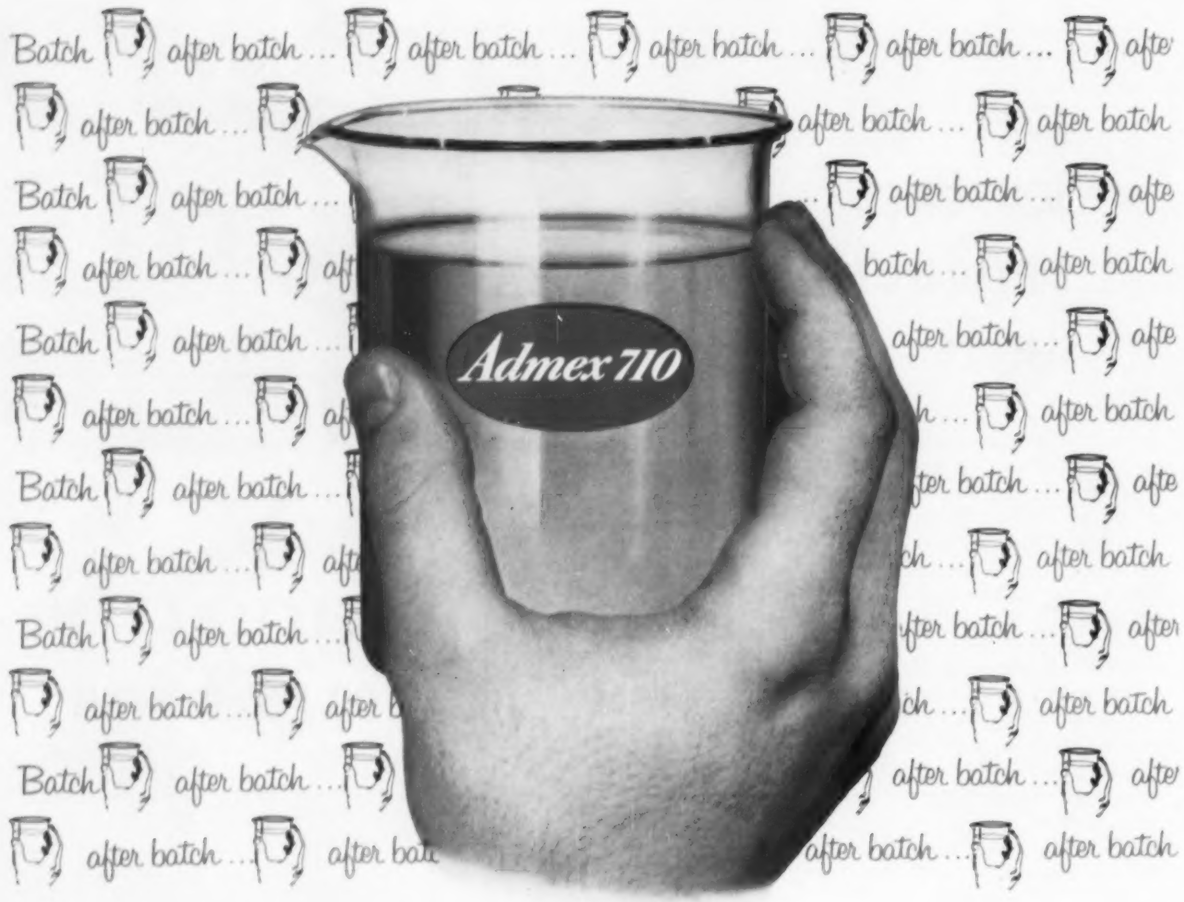
Farrel-Birmingham®

F-B PRODUCTION UNITS

Banbury Mixers, roll mills, calenders, extruders, plasticators, hydraulic presses and other equipment.

Watson-Stillman plastics injection, compression and transfer molding machines

FB-1021



50 production batches— prove *Admex 710* the most uniform, the most economical epoxy plasticizer!

How much could you increase your profits if your vinyl ingredients adhered rigidly to specifications . . . batch after batch? Variations from specifications make batch reproducibility difficult and costly . . . often require reformulating or "souping up" mixes.

If batch reproducibility is a problem in your plant, you'll be interested in the four graphs at the right. These suggest one solution to this problem. They show how 50 consecutive production batches of Admex 710 stayed well within rigid specifications. The iodine value varied less than one number from the average; the viscosity only 3/10 Stokes and, the acid value, less than 1/10 number. Percent epoxy oxygen showed no detectable variation.

Why is Admex 710 so good . . . so uniform? As a major soybean processor ADM selects ideal soybean oil for Admex. Then it's processed in stainless steel equipment and double-filtered. And each batch is double-checked by ADM control chemists before it is shipped. That's why *production of Admex has doubled* this past year.

Although comparison of the plasticizer you are now using with Admex 710 is a simple matter, it can be most important to your profits and the uniformity of your products. Why not make the comparison?

ADM technical men will be glad to assist you in evaluating Admex 710 and to explain its processing advantages: superior color and heat stability, better wetting, why it "goes over the rolls better." Once you know the Admex story you'll want to make full scale production tests. Take the first step. Write today for Admex Technical Bulletin 101-C and samples for evaluation.

to engineer greater safety into its cars. In this continuing effort, selected types of plastics—particularly some of the newer foam materials—appear destined to play a leading role.

Ford Motor Co. has made passenger safety a cornerstone of its 1956 sales program, which highlights the "Lifeguard" design of its new Ford and Mercury cars. More than two years ago, Ford undertook a program of research and testing to determine the causes of accident injuries. Safety "accidents" were staged wherein instruments and cameras recorded and measured the reaction of car "occupants" as well as the behavior of the car itself. Many thousands of dollars were spent destroying *property* in order to learn more about protecting *people*.

Impressed by Cornell University statistics indicating that about 38% of the injured front and center seat passengers are hurt on the instrument panel, Ford engineers conducted extensive research to determine the best available padding material for this area. The two types of plastics foams ultimately selected—vinyl plastisol foam and polyurethane foam— are described by Ford as five times more shock-absorbent than sponge rubber. Their superior protective qualities stem from the fact that, because they are firmer, they distribute the force over a wider area of the head or body.

Ford's new instrument panel crash pads are comprised of a basic underlying layer of vinyl chloride or polyurethane foam, over which an exterior cover of vacuum formed flexible acrylonitrile-butadiene-styrene sheeting has been applied. This construction results in a non-glaring type of panel cover which is easily wiped clean with a damp cloth, holds its shape well, and returns to its original contour after being depressed. Several suppliers and fabricating techniques are involved in producing these pads as well as the new flexible sun visors. In some instances, the preformed exterior cover is placed in a mold and the urethane material is foamed beneath it to complete the assembly. The technique followed by another supplier involves cementing the vacuum formed cover over a slab of vinyl plastisol foam having the required size and contour.

Ford's new "soft" sun visors are intended to minimize a very common source of head and facial injuries. One supplier, it is reported, first produces the foamed vinyl material, then molds the foam to shape by fusing it in gas-fired ovens. The plastic foam "biscuit," with an internal hardboard stiffener, is then covered with a vinyl film by heat sealing around the edges of the visor. Another supplier uses polyurethane foam, similarly covered by a heat-sealed vinyl skin, while a third has been molding visors with an integral vinyl plastisol skin.

Tailored properties

Unlike foam rubber, which is always "springy," the selected plastic foams can be made either

extremely "dead," with high energy absorption, or very lively, with rapid rebound, depending upon the basic formulations used and variations in processing techniques. They also exhibit good resistance to acids, alkalies, grease, soaps, etc., are stable in the presence of moisture, and are mildew-resistant. Their fire resistance is another "plus" characteristic as compared to foam rubber.

Favorable public reaction to the new Ford safety features is indicated by the fact that soon after announcement of the 1956 models, more than 70% of Ford purchasers were reported to be ordering the new plastic instrument panel and sun visors as extra-cost equipment. Around 25 to 30% were ordering factory- or dealer-installed seat belts.

Ford's extensive use of plastic foams in the applications cited by no means exhausts the current list of automotive components involving these products. Vinyl plastisol foam continues to be used on several makes of cars as the top, padded surface for arm rests, frequently in conjunction with a molded butyrate underside which contributes the necessary structural rigidity and adds a desirable note of color.

One producer of both vinyl- and urethane-type foams, predicts that the total market for urethane foam alone may reach 100 million lb. annually in the next five years. With the auto industry's growing interest in the concept of "packaging" the driver and his fellow passengers for increased safety, both polyvinyl chloride and urethane foams should play an increasingly important part in future automotive design thinking.

Formed sheet

With the rapid advancements being made both in thermoplastic sheet materials and in various fabricating techniques, including vacuum forming, more and more components produced by shaping selected plastics sheet stocks are making their appearance in the automotive industry. In addition to their increasing utilization as the outer shell or covering for cushioned dashboards, these materials are widely employed on the new cars for such applications as station wagon roof liners, front seat side shields, and intricately shaped covers for the heavy duty pillar to which the rear doors are hinged on the popular new four-door "hardtop" models.

Measuring approximately 112 in. long by 54 in. wide and weighing only about 7 lb., the largest formed plastics sheet component currently being used on any U.S. production car is the functional roof liner used in the 1956 Plymouth Suburban station wagons. This roof lining piece, which acts as insulation against extreme heat and cold and is easily kept clean by occasional wiping with a damp cloth is formed from white acrylonitrile - butadiene - styrene sheet material in an attractive white color. Prior to installation, the massive one-piece liner, having deep transverse ribs which

impart the necessary rigidity, is placed on a work surface, where a worker uses a templet to cut an opening in the piece to permit installation of the car's top light fixture. Next, two workers slide the entire unit through the back of the station wagon, much as a folded letter is slipped into an envelope. Once in position, the lining is secured in place by 47 screws which anchor the edge beneath the interior moldings. In addition, protruding metal tabs from the body interior pierce the edge of the liner and are hammered down to complete the installation.

Seat side shields

Among the numerous motor cars utilizing the same type of material for formed front seat side shields are the new Packard and Clipper models as well as some of the General Motors cars. The material provides a smooth, attractively styled, and sturdy panel having its own grained finish and color, which may be keyed to the upholstery trim or other interior appointments. The scuff-resistant plastics panels are not marred by frequent foot scuffing, are comfortable to the touch in either hot or cold weather, and are easily kept clean. As compared to a metal panel, these components have a desirable sound-deadening property.

In the 1956 Nash and Hudson automobiles, the top of the instrument panel is designed with a resilient crash pad formed of acrylonitrile - butadiene - styrene sheet stock, beneath which is a layer of impact absorbing material.

Pillar post covers

The introduction of the "four-door hardtop" models by various manufacturers has led to the development of an entirely new plastics application.

This new type of construction posed some real engineering problems. A sturdy upright steel structural member was provided to serve as an anchorage for the hinges of the rear doors and the latch mechanisms of the front doors. This member terminates below the level of the windows and has a flaring base or foot for secure anchorage.

Because of its T-shaped cross section and wide base portion, this new structural member introduced a new problem for the stylists. How could it best be concealed or made an attractive part of the car interior? This question has been met by the use of pillar post covers formed from acrylonitrile-butadiene-styrene sheet material in the desired colors and grained surfaces. A typical pair weighs approximately 1½ pounds. These covers, having intricate shapes which would have been impossible to duplicate in metal without costly fabricating and finishing operations, meet all functional and decorative requirements perfectly. They dramatically illustrate how changing concepts of automobile design may create completely new markets for plastics materials.

• • •

Next month: Nylon, vinyl, acrylic, Mylar, butyrate—in the 1956 cars.

Revere sticks

(*From pp. 95-98*)

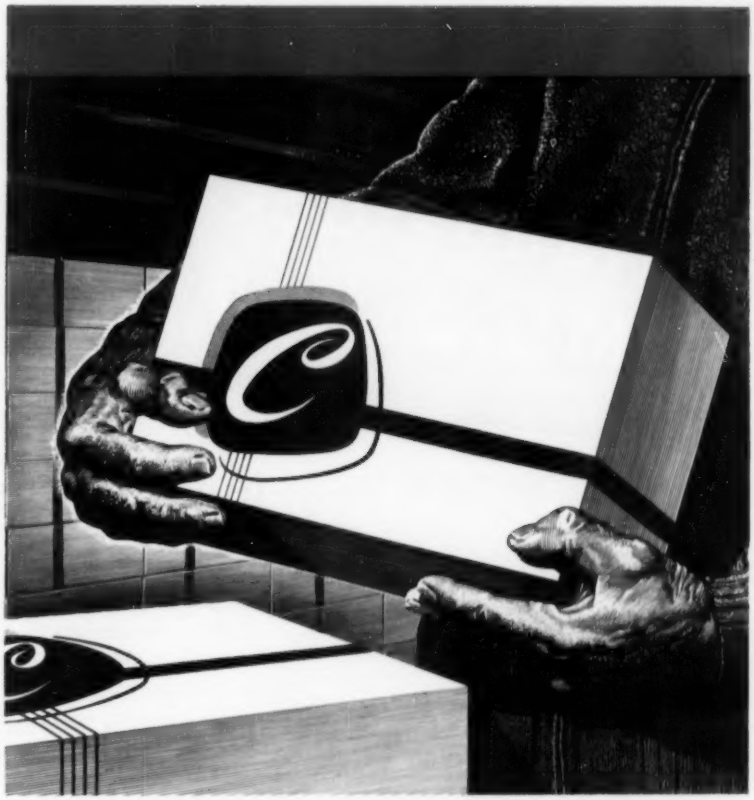
sign changes in the plastic parts. In making the plugs, Revere forms a preliminary part from the original wooden plug, then uses this part to produce a plaster female mold in which the epoxy plug is cast and cured. In order to meet the problem of accumulated heat build-up in the plugs, which sometimes leads to thickness variations in the plastic parts after the press has been operating for an extended period, Revere has just designed new mounting plates for the plugs which are of cast aluminum and have cooling fins to dissipate the heat. These replace wooden blocks previously used.

After the forming process, the plastic parts are separated by a band saw, then edge-trimmed by placing them on wooden fixtures and rotating them against a circular saw. Excess material removed in the trimming operations is salvaged as scrap. All required holes used in assembling the cord clip, spare reel spindle, and cover latch to the cover, as well as the ventilation opening at the bottom of the case section, are then punched out. The double-wall construction used on the case permits fittings to be riveted directly to the inner skin or liner of the cover without showing on the outside of the finished unit. The injection molded name plate, made with four studs on the back, is fastened to the cover by inserting the studs through openings in the formed part and flattening them with a soldering iron.

Flexible adhesive used

In the next phase of the case manufacturing operation, the stiffener, deeply ribbed for added strength, is cemented into the left side of the case and the liner is similarly mounted in the cover. For this purpose, a flexible type of adhesive supplied by Minnesota Mining is applied to the parts by brush. Small rubber rollers press the liners tightly into position for a lasting bond.

The aluminum bands which are applied to the trimmed edges of both halves of the case are deliv-

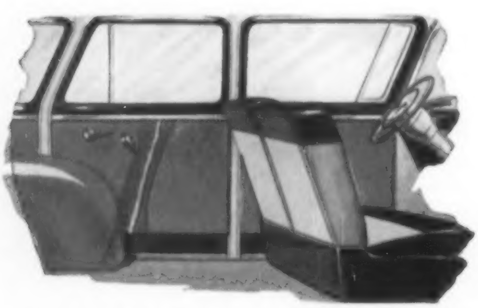


WHY NOT Naugatuck Marvibond

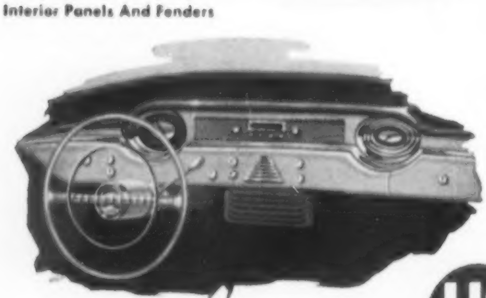
Catch-Alls

the new vinyl-to-metal laminating process?

Kick-Shield Panels



Interior Panels And Fenders



Radio/Heater Cabinets

Are you using sheet metals that have to be finished for appearance' sake... that do not add any additional sales value because the finish can chip, crack, or peel? Then why not consider the advantages of Marvibonded metals?

Marvibond* is Naugatuck's new laminating process that permanently bonds Marvinol® vinyls to practically any metal. Bonded in flat sheet form, these laminates can then be bent, crimped, drilled, punched, or deep-drawn without fracturing the finish—without weakening the adhesive. And they're available in practically any surface effect... glossy or matte finishes, leather-like grains, marble patterns, prints, weaves—even sculptured appearances.

Marvibond vinyl-to-metal laminates give surfaces that...

- **can't rust, rot, or corrode**
- **can't chip, crack, or craze**
- **are scuff- and stain-resistant**
- **are warm and friendly to the touch**
- **are clean, comfortable, and easy to maintain**

Marvibond laminates can be used almost everywhere that sheet metal is used... dashboards, window trim, door panels, truck cabs and other interior automotive components. Why not consider what Marvibonded metals offer in beauty, protection and serviceability, in *extra* sales appeal and production economies?

For technical data, samples, and the names of licensed Marvibond laminators in your area, write to the address below today.

*Patent applied for

SEE—Naugatuck Chemical Division, United States Rubber Company, at work on NBC's "Color Spread" TV spectacular, Sunday, March 25, 7:30 PM, EST.

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United States Rubber

Naugatuck Chemical Division

Naugatuck, Connecticut

BRANCHES: Akron • Boston • Gastonia, N. C. • Chicago • Los Angeles • Memphis • New York • Phila.
IN CANADA: Naugatuck Chemicals, Elmira, Ontario • Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices • Cable Address: Rubexport, N. Y.

ered to Revere in the form of extruded strips, cut to length and drilled with assembly holes. They include a wide extrusion which goes on the left-hand component and a narrower strip which trims the mating edge of the right-hand half or cover. The strips are bent to the proper outline by special tooling on a hydraulic forming machine, then anodized before being applied to the formed plastic assemblies. In forming the narrow band, an ingenious filler is used to prevent collapse of the extrusion when the roller sweeps around the forming plate. It consists of metal sections shaped to the extrusion, held together end-to-end by elastic cords.

No rivets needed

The shaped metal extrusions are attached to the case and cover without rivets or adhesive. Both strips are designed so that continuous teeth bite securely into the plastic sheet material when the bands are mechanically squeezed onto the edges of the sections. The machine used to apply the bands is, in effect, a master die which insures a correct, finished profile of the case and lid. It functions by an arrangement of four hydraulic cylinders which expand to compress the case and band against the master die, insuring a perfect fit between the case and lid, uniformity of size, and complete interchangeability of parts. Separate dies, mounted on the same machine, apply the wide and narrow bands.

After being applied to the edge of the case, the wide extrusion is drilled, counterbored, and tapped around the perimeter of its inner flange. These tapped holes accommodate the screws used to mount the heavy-gage sheet steel plate that is later assembled to this side of the case, and which in turn serves as the principal structural unit on which the entire projector is assembled. The folding front leg of the projector and the telescoping rear leg, which may be adjusted for height, are also anchored to this rigid base.

Final assembly operations on the lid section of the case include mounting of the heavy-duty carrying handle, which is molded of impact styrene material, and the circular case lock knob, which is molded of the same type plastic and includes a recessed rib so that it may be conveniently grasped and turned. A compression spring on the shaft of this knob provides tension for a tight fit when the cover is locked. The metal shafts at each end of the retractable carrying handle pass through molded nylon sleeves mounted through openings in the wide metal band encircling the case. These sleeves have the long life and smooth action unobtainable in metal-to-metal contact, and require no lubrication.

Credits: Model 777 projector cases formed from Royalite copolymer sheet stock supplied by United States Rubber Co. Molded carrying handle, case lock, and spindle for extra reel, National Lock Co., Rockford, Ill. Molded nylon sleeves for handle mounting, Thorgen Tool & Mfg. Co., Valparaiso, Ind. Epoxy resin for punches, Rezolin, Inc., Los Angeles, Calif.

Carrying case

(From pp. 102-103)

telescopes over the bottom half, a close fit is required between the two parts. In most such designs, a vacuum is formed when closing the unit, requiring slight additional pressure when opening. In the polyethylene carrying case, however, the space between the ribs serves as a vacuum leak and provides an efficient slip action between top and bottom halves.

Finishing operations

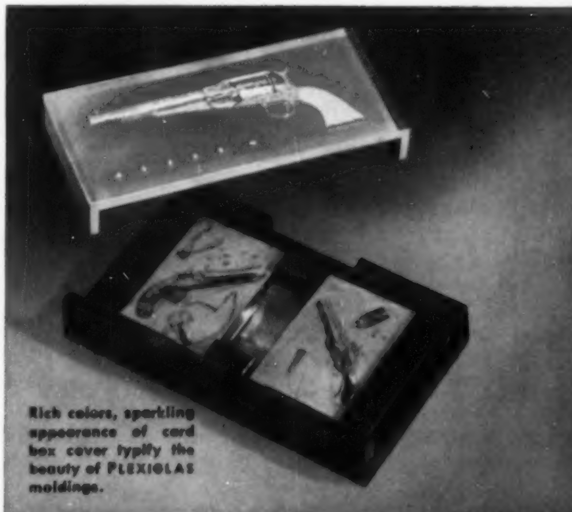
Matching the utility of the polyethylene carrying case is its high quality appearance. With the exception of the five parallel bands around the lip, the entire outside surface of the top half of the case is molded in an attractive leather grain finish.

Also molded into one face of the top half of the case is a raised pad with the Ronson name in depressed lettering. Hot stamping colors the raised pad black, leaving the recessed letters in contrasting ivory.

The end result is a simple, yet highly distinctive, carrying case that fits neatly into the luxury concept of the electric shaver. Reportedly, other manufacturers of electric shavers are seriously considering polyethylene carrying cases which are molded along similar lines.

More important, allied fields which require a similar degree of quality packaging are watching the application with interest. Until the Ronson case, with its large-volume production run, came along, molded polyethylene packaging of this type was limited to small-volume specialized items, such as precision tools, medical instruments, etc. (see "Molded Cases for Precision Packaging," MODERN PLASTICS, *32*, p. 112, April '55). Any success which the Ronson case may have could well be the incentive that will stimulate a more extensive use of polyethylene quality packaging by a wider range of industries.

Credits: Case is molded for Ronson by Auburn Button Works, Inc., Auburn, N. Y., using DYNH polyethylene supplied by Bakelite Co.



Rich colors, sparkling appearance of card box cover typify the beauty of PLEXIGLAS moldings.

Water meter cover molded of PLEXIGLAS has excellent clarity, high resistance to impact.

PLEXIGLAS gives weather-resistance, light weight, great strength to insulation clamp for power cables.

Designed with **PLEXIGLAS** *in mind*

Products like those shown above have proved successful because their designers and molders took advantage of the properties of PLEXIGLAS® acrylic plastic. Whether *your* requirements for a molded part are rugged durability or gleaming beauty, or both, PLEXIGLAS can provide the answer.

Here are the reasons why so many types of products in varied fields of industry today are planned to be molded of PLEXIGLAS—the resistance of this acrylic plastic to weather, heat and breakage . . . its crystal clarity, resulting in depth and brilliance of colors when back-surface paints and metallized coatings are applied . . . the optical effects possible . . . its ability to be molded accurately into complex shapes.

Our technical representatives and Design Laboratory staff would like to show you how PLEXIGLAS can solve specific problems involving molded plastic parts.

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Calculators

(*From pp. 108-112*)

culators of heavier construction, the case is produced by fastening two die-cut pieces of plastic sheet stock together at several points around the edges. Other strips having approximately the same thickness as the movable slides are used as separators.

Final assembly of the calculators involves inserting the slides in their matching sleeves or cases, securing dial-type units together by means of metal eyelets, or mounting spring-loaded cursors in position on the cases. Automatic eyeletting machines may be used to speed up the assembly process. Finished instruments are then checked individually for appearance, proper assembly, and smooth operation.

Typical plastics devices

From the dozens of calculators, selectors, and similar devices made largely or entirely of plastics, a few have been selected for description and illustration. These will point up the possibilities and indicate the potentials of plastics in this expanding field.

Acu-Rule Mfg. Co., Mt. Olive, Ill., for example, makes use of Bakelite vinyl sheet in producing a line of engraved slide rules in both pocket and desk models. These rules have smooth machined "tongue-and-groove" surfaces which provide uniform sliding action under a wide range of temperature and humidity conditions. The accurate, easy-to-read scale markings are engraved in black; numerals and some scale indices are also engraved and shown in red on the trigonometric and logarithmic models.

The Dollar-Dialer, produced for I. & M. Ottenheimer, Baltimore, Md., by Malco Plastics, Inc., is an ingenious currency converter which quickly translates U. S. dollars into 26 foreign currencies at the turn of a dial. Easily carried in wallet, pocket, or passport case, the Dollar-Dialer is fabricated of Bakelite vinyl sheet. Alternate two-color printing facilitates visual lineup and accurate reading.

A new slide rule developed by Chicago Molded Products Corp. to provide a quick, easy method of computing the cost of single stock sheets of the company's Campco rubber-modified styrene material is, interestingly enough, fabricated from Campco sheeting itself. The two parts of the ruler consist of the outer case, folded along each outside edge, and a traveling scale which fits within the case. By setting the gage in inches against the total area in square inches, cost per sheet in various thicknesses and weight per sheet are read directly.

The Junior Navigator for small boat owners, produced by A. Barrus, Mt. Vernon, N. Y., is a new piloting instrument which combines practically all information needed for offshore piloting. The data are printed on both sides of a 7½- by 10-in. card on which is mounted a rotating disk. Compass markings and printing in three colors are protected from rain, salt spray, engine oil, gaso-

line, and grease by a clear vinyl overlay. One side of the unit has a glossy finish; the other has a matte surface on which pencilled notes may be made in laying out a course. A string with a magnifying glass at one end is attached to the center of the disk as a plumbing device.

Graphic Calculator Co., Chicago, a supplier of both stock and custom-designed calculators, selectors, visualizers, and related devices, makes extensive use of Bakelite vinyl sheet stock in the fabrication of these instruments. One such unit is the R. G. Bock P. Q. Scope for Industry, designed to control and raise production levels. When samples of a worker's output have been inspected, the quality level is charted by the inspector. A sliding signal arm at the top of the scope is then set to measure the product quality level with the standard of expectancy. Various types of forms and charts are available for recording and graphing quality, quantity, and ranges of deviation.

Also made by Graphic is the Chace Thermostatic Bimetal Calculator, a highly technical device which facilitates engineering calculations in connection with heat control equipment. With the exception of a 0.060-in. clear transparent Plexiglas cursor, this calculator is fabricated mainly from 0.040-in. Bakelite vinyl sheet stock. In producing this unit, the fabricator silk-screened the background colors on white opaque sheet stock, then printed the scales over the background colors, providing immediate visual identification for the five movable scales, which are printed on both sides.

In the production of the AMI Visualizer, which enables prospective automatic phonograph purchasers to view 512 color and location combinations for diners, restaurants, cocktail lounges, etc., the two top sections are of vinyl sheet stock, used in combination with a special paperboard base. This sales stimulating device involved eight-color printing, with the top vinyl sheet going through the press 13 times in order to obtain the desired color effect.

Designed and produced for the Director of Medical Psychology at the School of Medicine, University of Chicago, the Halstead Aphasia Test, used in VA hospitals, consists of spiral-bound 0.010-in. vinyl cards, printed in four colors and mounted in a leatherette case. In using this device, words and symbols on the cards are viewed through a window in the front of the case.

For the U. S. Forest Service, Sillcocks-Miller Co., Maplewood, N. J., fabricates a plastic calculator known as the Burning Index Meter. The design of this instrument permits all the variables of weather, humidity, and other natural conditions to be coordinated into a single figure that accurately estimates the mathematical possibilities for a fire in any section of the national forests.

The Emeloid Co., Inc., Hillside, N. J., major producer of vinyl laminate calculators, has recently come out with three ingenious devices in the category of circular

calculators making use of two or more rotating scales.

One is a psychrometric calculator developed by Emeloid for the U. S. Army Signal Corps, used for computing dew point and relative humidity. Scales are printed on both sides of the vinyl center disk; over each side is a rotating scale printed in six colors. A heavy swinging pointer arm of transparent vinyl, which also has a scale printed on it, is attached with a metal fastener to the center of the main disk.

Second is a radio transmission line calculator which also makes use of a swinging arm of transparent vinyl. For improving reading accuracy, the pointer arm itself is equipped with a smaller medial slide that has one vertical line printed on it. The medial slide, also fabricated of transparent vinyl, is assembled to the arm by folding the edges of the slide over the sides of the arm.

Third of the new devices, known as the Conceptulator, is fabricated by Emeloid for Fielding Assoc., Stamford, Conn. The Conceptulator is designed to compute female menstrual cycles and periods of fertility. It consists of two circular vinyl scales that rotate over a fixed square vinyl sheet marked off with the days of the year. An unusual feature of the device is the system worked out to permit the two circular scales to rotate together—a necessary arrangement during certain phases of the computations. When the top scale, which is printed on a sheet of transparent vinyl, is located in proper position, one of a series of holes die-cut around the circumference of the top scale is simply snapped over a metal stud projecting out through a die-cut hole in the bottom scale. The two scales are thus locked together during rotation—but can just as easily be unsnapped.

A fourth calculating device also produced for Fielding Assoc. by Emeloid is another currency guide for translating foreign moneys into dollars and cents. The device is in the form of a compact booklet made up of 12 sheets of press-polished vinyl spirally bound together. Eight of these sheets are printed front and back with the currency values in 16 different European countries and their monetary equivalent in dollars. Each page is equipped with a sliding marker that facilitates checking any particular sum.

Sheet plastic templets

Closely related to slide rules and calculators in that they save time and simplify repetitious tasks in engineering and drafting departments, are many types of templets produced by blanking plastic sheet stocks. Rigid vinyl sheet stock, laminated for maximum durability and protection of printed matter, is utilized by J. B. Carroll Co., Chicago, in producing such items as the Harmony House Kitchen Planning Template, used in drawing accurately scaled outlines of refrigerators, sinks, cabinets, etc., and the C. R. S. I. Concrete Joist Template. The fabrication of the latter templet, which is utilized in drawing concrete joist form outlines on construction plans, involved

unusually exacting indexing and blanking operation on the plastic sheet stock. Without a very high degree of accuracy, such a templet would be less than useless and might actually lead to serious construction errors.

E. F. Twomey Co., Inc., Los Angeles, Calif., which fabricates a complete line of drafting templets for electrical and electronic symbols, fluid fittings, nuts and bolts, etc., works with 0.025-in. rigid vinyl sheet which produces a durable, long-lasting templet combining accuracy and dimensional stability.

Specialized calculators

From A. Lawrence Karp, Greenwich, Conn., comes a new matched set of five reversible vinyl templets for drawing general layouts or details of piping and valving systems used in fluid process work. At least 5000 commonly used piping, fitting, and valving diagrams can be drawn accurately with pencil or stylus by using the cut-out symbols on the templets singly or in combination. Major users include such industries as plastics, chemicals, brewing, bottling, beverage making, heating and refrigeration, fluid foods, and cosmetics.

One of the most unusual units made by Carroll is the JM Roof Area Calculator, a compact unit used for calculating the total area to be covered by shingles. Measuring 6 in. square, this calculator consists of a case produced of folded clear transparent vinyl sheet stock, printed and silk-screened on the reverse side, used in combination with a paper slide on which two sets of scales are printed. A unique feature of this calculator is a triangular window, made by leaving a section of the case unprinted, through which an actual roof may be viewed to determine the pitch, as marked by lines on the calculator. Once this factor has been determined visually, the total roof area may be read directly from the proper scale.

In earlier years, engineers were inclined to look askance at plastic calculators, slide rules, etc., regarding them largely as "gadgets." However, with improved standards of accuracy, better and more stable plastic materials, and improved production methods by fabricators, devices of this type are now becoming increasingly accepted by technical as well as merchandising men. During World War II, the use of thousands of fabricated plastic computers, navigational aids, etc., showed the exacting type of results which could be achieved with such devices and helped to build greater acceptance for the calculators in business and industry.

If an engineer can arrive at an accurate specification or solve a difficult technical problem within a few seconds by manipulating an easily handled calculator, would he actually prefer to spend a much longer period poring over charts or thumbing his way through closely printed pages? The answer to that one is easy—and it helps to account for the steadily growing use of plastics in this expanding field.—END

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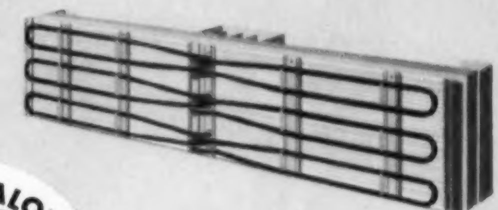

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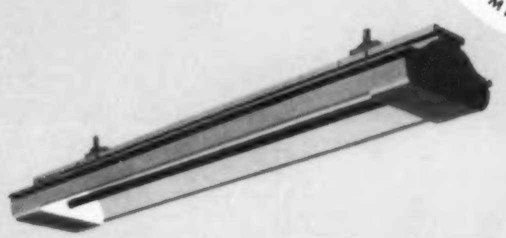

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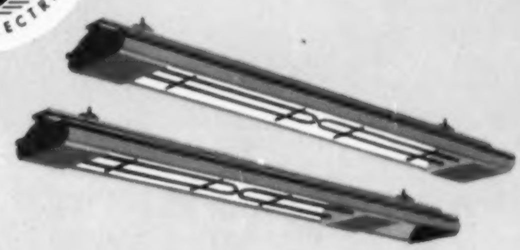

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ADHESIVES FOR PLASTICS. Chart provides information on properties of thirty typical adhesive formulations, taken from the extensive series of adhesives offered by this company for bonding plastics and metals. Rubber and Asbestos Corporation. (C-603)

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HYDRAULIC PRESSES. Specifications and illustrations of a complete line of hydraulic presses for compression molding, transfer molding, laminating, reinforced plastic molding, hobbing, and laboratory work. Clifton Hydraulic Press Company. (C-607)

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PHTHALATE ESTER-TYPE PLASTICIZER. 16-page technical booklet gives full details on properties, performance, and instructions for casing "Staflex KA," a plasticizer suitable for use with a variety of resins. Deecy Products Co. (C-616)

SMALL AUTOMATIC DRILLING UNITS. Illustrated 23-page catalog gives details on a line of small automatic electric-pneumatic drill units, electric drill heads, and a small diameter drill grinder. Dumore Precisions Tools. (C-617)

ELECTRIC CARTRIDGE HEATERS. Illustrated literature lists specifications and describes construction features of six types of "Chromalox" electric cartridge heaters, for spot heating jobs. Edwin L. Wiegand Co. (C-618)

SMALL HYDRAULIC PRESSES. Catalog gives detailed facts and photos on company's line of small air-powered "Hydrolair" hydraulic compression presses. 30, 50, 75, and 100 ton models are available. Detailed specifications and optional modifications are also given. Elmes Engineering Division, American Steel Foundries. (C-619)

HANDBOOK OF SPECIAL-PURPOSE ADDITIVES. 36-page illustrated handbook describes five grades of "Chlorowax" chlorinated paraffin additives for plastics compounds, formulated to improve chemical resistance, flame retardance, and water repellence. Diamond Alkali Co. (C-620)

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HYDRAULIC PRESSES. Booklet pictures typical examples of this company's giant-size hydraulic presses used in the manufacture of laminated plastics. Units with pressures up to 5,000 tons and platen areas as large as 100 by 52 inches are described. Fjellman-American, Inc. (C-632)

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Food bins

(From page 113)

them to pivot freely on the facia. Molded-in at the top of the bins are grips for pulling the bins out.

The design of the bins is such that there is no danger of their falling out of the cabinet even when they are tilted fully forward. However, the bins can be easily lifted from the cabinet for cleaning purposes and are as easily replaced.

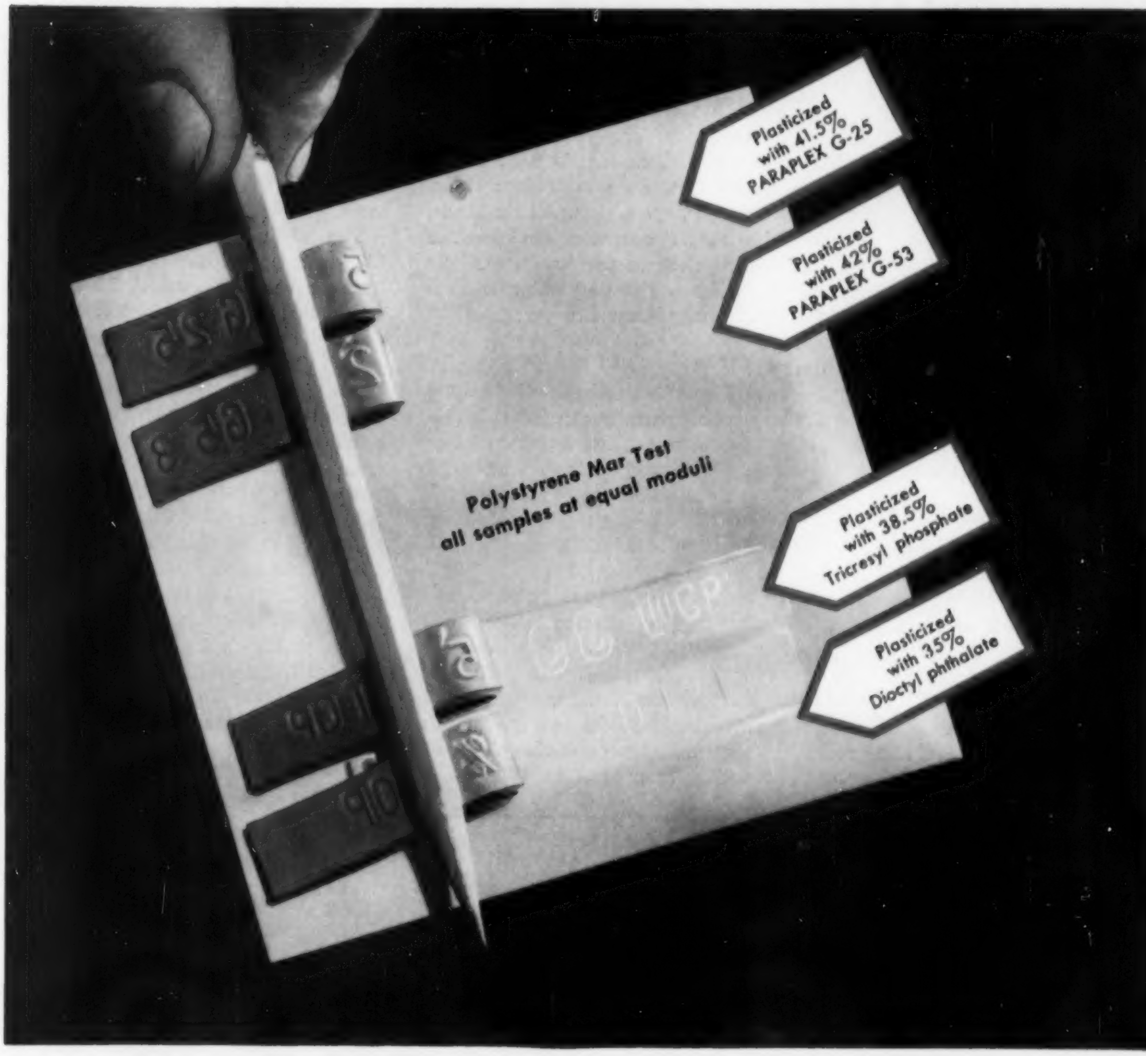
Assembly of the Bin-Ette is a relatively simple matter: first the back plate is jig-fitted to studs molded into the inside back of the cabinet. The studs are then heat deformed, holding the back plate securely in place. Next the facia is toluene-cemented to the front of the cabinet. Finally, the bins are set into place and the assembly is complete.

Advantages

According to the designers who developed the product, the reasons why high-impact styrene was chosen for this application were as follows: the material is corrosion resistant, strong enough to withstand the normal abuse to which it is subjected in the kitchen, odorless, easy to clean, will not scratch table tops, can be molded into smart and functional designs, and offers a complete range of colorability for ready integration with the high-styled kitchen of today. Finally, the material permits molding-in of legs, grips, studs, and similar parts, reducing assembly costs and making possible competitive pricing.

As an indication of the superior design qualities of this product, the Bin-Ette has been selected as an example of good design for the annual California Design show, held in the Pasadena Art Museum.

Credits: Bin-Ette designed by Henry Keck Assoc., Pasadena, Calif.; manufactured by B W Molded Plastics, Pasadena, of high-impact styrene supplied by The Dow Chemical Co., Monsanto Chemical Co., and Koppers Co., Inc., on injection machine produced by Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.


Plasticized with 41.5% PARAPLEX G-25
Plasticized with 42% PARAPLEX G-53
Polystyrene Mar Test
all samples at equal moduli
Plasticized with 38.5% Tricresyl phosphate
Plasticized with 35% Dioctyl phthalate

Trapped-sheet

(From pp. 117-124)

bubbles which would cause optical irregularities in the finished lid. In (c) the central part of the hot mold half has reached its most forward position; at (d) the outside annular cylinder of the mold has advanced to form the outer lip of the lid. Compressed air is then forced against the opposite side of the blank through the heater block assembly to form (e) the closure. In (f), the finished closure is ejected from the opening mold into discharge chute. The cycle takes five seconds.

Operating procedure

For maximum economy and quality of closures, it is advisable to use the machine around the clock. A relatively long warm-up period is required before stabilization of temperature is assured, making short runs impractical.

Because of the uniformity of Polyflex sheet, the high reproducibility of the forming process, and the continuous operating schedule, the closures are dimensionally uniform. Visual inspection for occasional molding defects is the only inspection necessary. Total variation of the closure diameters is 0.005 in. or only 0.1% on a 5-in. closure! On a 5-sec. cycle, using all six heads, a single operator can produce 4320 closures per hr. on a single machine. Forming waste is consistently below five percent.

Versatility of machine

This "trapped-sheet" forming process permits considerable undercut on the internal diameter of the closure, since "snapback" from the mold surfaces is approximately 1% on the diameter. Ejection is helped by the flexibility of the piece. There is a compromise on the amount of undercut selected; if there is too much, the finished closure will not eject without buckling, but good closure nesting resulting from a wide stacking shoulder is necessary to prevent warpage during the final cooling after ejection.

The process has an advantage over vacuum forming in that it produces less thinning-out of the material at corners; therefore, more complicated shapes may be made. In addition, highly defined embossing can be obtained by engraving the cold surface of the mold.

The original design of the EM-132 dealt specifically with container covers of nominal 5.5-in. maximum diameter and 0.25-in. depth. However, the basic design permits its use for making noncircular shapes as well as shapes of greater area and depth. The cam-driven timing mechanism may be quickly and accurately adjusted with set-screws, and the cam speed may be varied from 8 to 14 r.p.m. The six units operate in unison from the same cam settings, but may be separately stopped for adjustment, maintenance, or for changing one mold without disturbing the operation of the others. On a 24-hr./day basis, the EM-132 can produce more than 20 million pieces per year!—END

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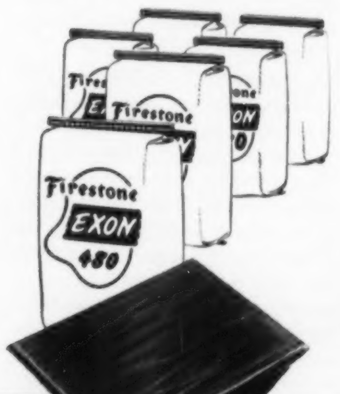

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Bonding

(*From pp.* 126-137)

The situation is analogous to the production of the different grades of General Motors cars. A Cadillac car is higher-priced than a Chevrolet not only because many of the materials used in the Cadillac are more costly, but also because there are higher labor costs. The Cadillac, because it is a premium product, requires more careful work and more critical supervision during manufacture than does the Chevrolet.

In essence, since you must pay for what you get, don't ask for more than you need!

Curves showing strength as a function of temperature for three epoxy-based bonding materials are given in Fig. 13. These materials span a two-fold spread in price. Clearly, Bondmaster M611+MPD (curve *A**) is the best of all, insofar as retention of strength at high temperature goes—even at 370° F. it retains more than half of its room-temperature strength. Material *C*, on the other hand, represents the opposite extreme, and has no strength at all at any temperature above 230° F. Material *B** is intermediate. At about 70 to 80° F., however, all three of these materials are practically identical in strength. For end-use service in that temperature range there would seem to be little, if any, basis for choice between them—until their prices are compared!

Conclusion

Recent advances in the field of synthetic resins and elastomers have provided the adhesive formulator with the raw materials for adhesives that are structural in their properties and that are extremely useful in bonding plastics to plastics, to reinforced plastics, and to metals. While existing adhesives may not solve all bonding problems, they are, we feel, far more useful and versatile than designers suspect. Certainly, the inability to use a heat-cure in production no longer rules out the effective use of epoxy-based adhesives.—END

*In Fig. 13, p. 137, curve *B* should be labeled *A*, and vice versa.

In tension

(*From pp.* 156–162)

there is, however, a considerable difference in the properties of the laminate; it is reasonable to attribute some of this to the change that would surely be brought about in the value of the coefficient of friction by the surface treatment to which the glass cloth had been subjected.

In equation 8 we see that the falling off in modulus is proportional to the load *W* on the specimen. This is apparent on Fig. 3 where the slope or modulus decreases gradually from its initial to its final value. The decrease is quite slight in this case as the specimen was prepared with satin cloth reinforcement and the fibers were quite long, so any influence that might be more marked in the case of specimen prepared with short fibers would be present but not marked.

We also see that the reduction in modulus is inversely proportional to the ultimate tensile strength of the resin. This implies that we could expect better properties from a laminate if a resin with a higher yield point were used. This may partially explain the better properties that are associated with epoxide resins compared to polyesters (1). The yield point of epoxide resins is higher than that of polyesters, consequently the falling off in modulus is less.

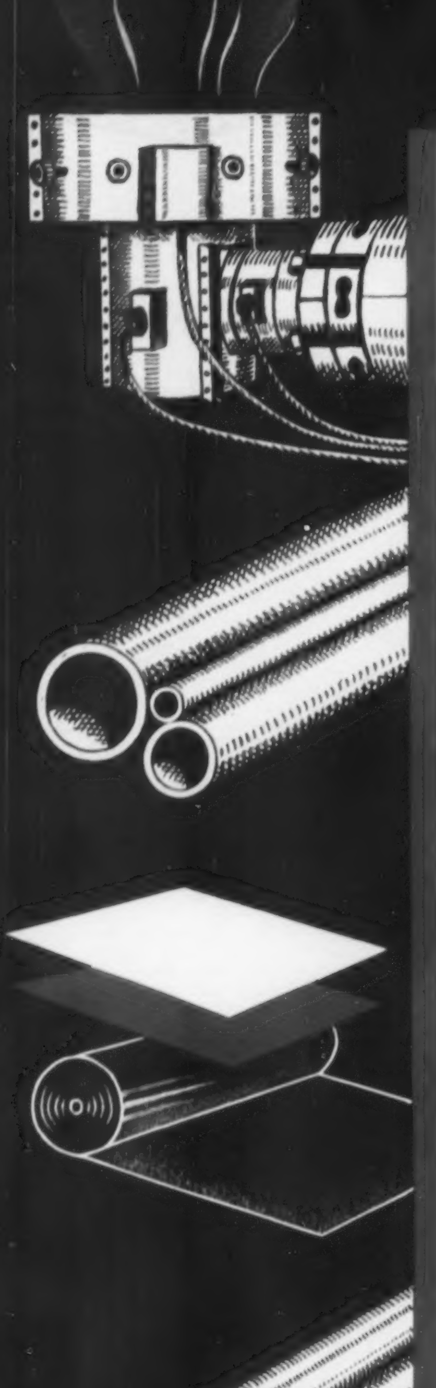
Diameter-length ratio

The diameter-length ratio influences the modulus as shown. If this ratio decreases or the length of fibers is increased, the modulus will be greater. This agrees with observed practice (1).

If the thickness of the resin film, *t*, around the fiber is decreased the falling off in modulus will be increased. This may be apparent in resin-starved laminates where the fibers are not adequately supported and unsatisfactory properties result (1).

The final term in the equation is the modulus of elasticity of glass. That this should affect the modulus of the over-all material

(*To page* 248)



on a Reifenhäuser!

(with screw diameters 1,18" - 1,77" - 2,36" - 3,58" - 5,9" approx.)

Cylinder
The forged screw cylinder is easily replaced . . . it has three independently adjustable heating zones . . . the cylinder holds the screw in a perfectly coaxial position by means of roller bearings . . . the cylinder liner can be supplied nitrated, hard-chrome plated, or of a normalized corrosion-proof material.

Screw
These are supplied with nitrated, or corrosion-proof finish . . . special designs for a variety of compounds are available.

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Individual heating zone control by thermocouples with plus/minus 1 Centigrade accuracy.

Temperature Controls
All temperature controls and indicators are grouped in one compact panel . . . control pyrometers provide precise temperature regulation, even at high temperatures.

Feed Hopper
The hopper has agitator arms driven by an auxiliary motor to assure perfect feeding of material to cylinder.

BOPP

Heating Capacity

for the cylinder with straight line head	13.500 watts
measuring range of Temperature	
Regulators	20 - 300° C
or	20 - 400° C
accuracy of heat regulation	+ 1° C
sea space when packed	about 35 ft^3
gross weight	about 5300 lbs
floor dimensions	8'3" x 8'3" approx.

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Mexico: Huber de Mexico S.A.,
Comte 85, N. Anzures, Mexico D.F.

South-Africa: Koupé & Wilde, (South Africa) PTY. Ltd.
Cape Times Building,
St. George's Street, Cape Town

Venezuela: VENUFIX C.A.
Avenida Victoria,
Apartado 3757
Caracas

is directly apparent. If we substitute

$$E_c = \frac{A_G}{A_G + A_R} \cdot E_G$$

from equation 3 in equation 8, we obtain:

$$E_{cs} = E_G \left(\frac{A_G}{A_G + A_R} - \frac{1}{4\mu} W \frac{1}{F} \cdot \frac{D}{l} \cdot \frac{D}{t} \right)$$

and it appears that the modulus of the composite material is always directly proportional to that of the reinforcing material.

Conclusion

By critically analyzing the mechanics of the fibers comprising a reinforced plastic laminate as well as by observing the location of these fibers in the laminate, we can relate the properties of the laminate to that of its constituents. These predicted properties are shown to be in accord with observed properties and serve to explain some of the anomalies regarding the behavior of reinforced plastics. Particularly we can see that the effect of adhesion is negligible after preloading; rather, it is the coefficient of friction between the fiber and the resin that is a determining factor. The theory developed helps to explain the influence of surface treatment of the glass as well as to show the importance of having a high value of yield point for the resin in obtaining a material of uniformly high modulus using shortened fibers for reinforcement.

The author wishes to express his thanks to Dr. Egon Orowan of the Massachusetts Institute of Technology for his encouragement and advice.

References

1. Sonneborn, R. H., "Fiberglas Reinforced Plastics." 1954. New York: Reinhold Publishing Corp.
2. Freas, A. D., Trans. A.S.M.E. 75, 621 (1953)
3. Werren, F., "The Effect of Fabric Finish and Wet Exposure on the Strength Properties of Glass Cloth Laminate." Wright Air Development Center Technical Report (1953)
4. Morgan, P., "Glass Reinforced Plastics." 1954. London: Iliffe and Sons, Ltd.—END

Heat-resistant

(From pp. 163-166)

and the three isomers of methylstyrene are favorable for the formation of a homogeneous polymer.

Physical properties of this copolymer are shown in Table III. Just as polymethylstyrene has improved heat resistance over polystyrene, so the methylstyrene-acrylonitrile copolymer possesses heat resistance better than the corresponding styrene-acrylonitrile copolymer (Fig. 7).

Thus, the methylstyrene-acrylonitrile copolymer combines toughness, heat resistance, and reasonably low cost with improved resistance to crazing, chemicals, and abrasion. Some typical moldings of this copolymer are illustrated in household and industrial applications in Fig. 8, p. 252. Less than 1% dimensional change occurred in these moldings after 30 min. in boiling water.

This copolymer may be molded similarly to polystyrene with the only alterations in molding conditions being a slight increase in cylinder and mold temperatures (i.e., 50 to 75° F.). All of the common types of mold gating have been used.

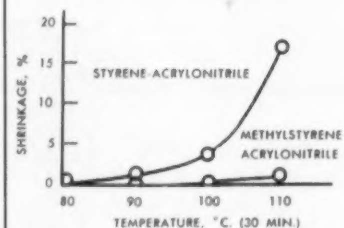


Fig. 7: Percent shrinkage versus temperature of acrylonitrile copolymers

Methylstyrene has also been found to be at least an equivalent for styrene in many other and varied fields. It has been found to be an equivalent for styrene in GR-S formulations; no significant preferential isomer buildup occurred when methylstyrene was exhaustively recycled with butadiene. Methylstyrene has been successfully evaluated for surface coatings in latex and styrenated

alkyd paints. With alkyds, methylstyrene can be more advantageously used than styrene because of the increased compatibility with less expensive solvents. Methylstyrene has also shown promise for use in paper, textile, and polyester resin applications.

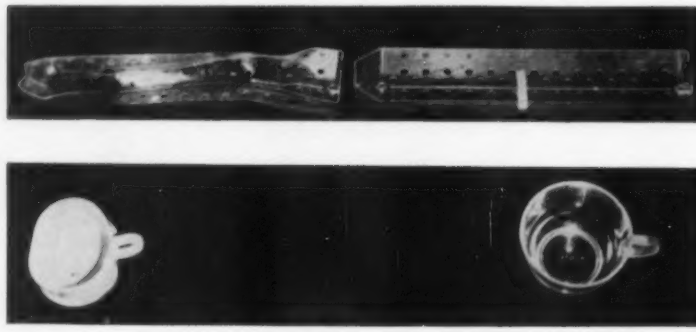


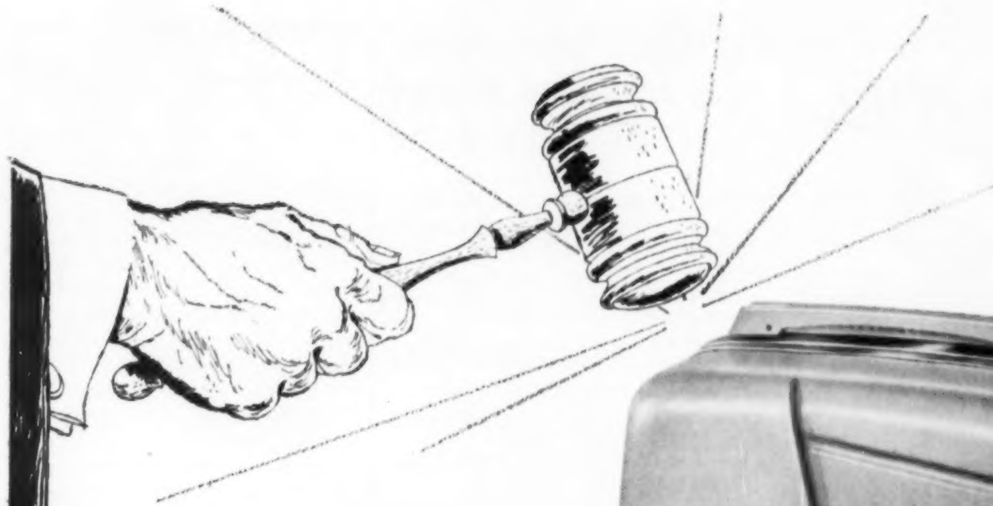
Fig. 8: Effect of immersion in water for 30 min. at 100° C. on methylstyrene-acrylonitrile and styrene-acrylonitrile moldings. The methylstyrene-acrylonitrile moldings are at right, styrene-acrylonitrile moldings are at left. Pictured in top photo are moldings of a junction box, bottom photo shows two molded cups

Acknowledgments

The author in presenting this paper does so on behalf of many associates at the American Cyanamid Co. at Stamford, Conn., whose contributions in this field and also the contributions that were made by the staff of the Dominion Tar and Chemical Co. at Montreal, Canada, are gratefully acknowledged.

References

1. J. Am. Chem. Soc. *27*, 1708-1710 (March 20, 1955).
2. J. Polymer Science *16*, 143-154 (April 1955).
3. J. Am. Chem. Soc. *67*, 736-738 (May 1946).
4. J. Am. Chem. Soc. *68*, 861-868 (May 1946)
5. J. Am. Chem. Soc. *68*, 1085-1088 (June 1946).
6. J. Am. Chem. Soc. *68*, 1088-1091 (June 1946).
7. J. Am. Chem. Soc. *68*, 1365-1368 (July 1946).
8. J. Am. Chem. Soc. *68*, 1159-1161 (July 1946).
9. U. S. Patent 2,398,483.
10. Colloid Chemistry *6*, 1010-1013 (1946).
11. U. S. Patent 2,373,982 (to Dominion Tar and Chemical Company).
12. Ind. Eng. Chem. *46*, 652-660 (April 1954).
13. Boundy, R. H. and Boyer R. F., "Styrene." 1952. New York: Reinhold Publishing Corp.
14. Detailed data to be published by D. L. Swanson, American Cyanamid Co.—END



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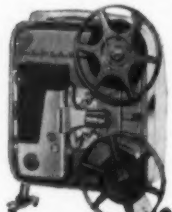

To win, time after time, in the trial of use and abuse, any "portable" must have an eye-appealing case that stands up under hard knocks. A case like that of the fine, precision-built "777" portable projector, *formed from* U. S. ROYALITE.

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Grading by ZST

(*From page* 167)

plates on the press platens. After 2 min. of preheating, pressure is applied for 1 minute. The amount of pressure required to give a 0.062 in. specimen will vary with the press and should be established by trial. Immediately after the completion of the actual press period, the load is removed and the metal plates and plastic sheet are quenched in cold water. The 0.062 in. thick sheet is then stripped from the metal plates. A minimum of two test strips 2 in. long and 3/16 in. wide are cut and notched.

The cross-section of the plastic at the notch should be 0.047 $\pm$ 0.001 in. wide by 0.062 $\pm$0.003 in. thick. One end of the specimen is held in the clip-type holder provided with the ZST tester and a 7.5 $\pm$0.1 g. weight is attached to the free end. The specimens (which are usually run in pairs) are placed in the ZST tester furnace and the various times that are required for the specimens to break at the notch are then recorded.

Polyethylenes tested

The above procedure has been carried out with several different samples of polyethylene. Among those tested were a group of polymers of known number average molecular weight received from Imperial Chemical Industries through the courtesy of Dr. J. D. Burnett. These polymers were tested at ZST tester temperatures of 130, 140, 150, 160, and 175° C. respectively. The measured ZST values plotted logarithmically against molecular weight are shown in Fig. 1, p. 167. There is at every ZST tester temperature a satisfactory linear relationship between the log of the ZST values and the number average molecular weight of the material being tested.

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work we have preferred to conduct the tests at a temperature of 150° C.

Several molecular weight grades of Bakelite polyethylene were tested at 150° C.; the results are presented in Table I, p. 167. These data also show a linear relationship between log ZST and molecular weight. As a matter of fact, the narrow range of molecular weights results in a linear relationship between ZST and molecular weight. It should be noted that the Bakelite molecular weight values are viscosity average values while the ICI molecular weights are number averages.

Some commercial samples of Du Pont's Alathon polyethylene were also investigated (Table II, p. 167). Molecular weights were not available for these samples, so only the melt index values available from Du Pont literature are given.

Table III: ZST values for low-pressure polyethylenes

Material	*ZST value*	*Melt index*
	sec.	*g./10 min.*
Phillip's Marlex 50	400	0.6
Koppers' Super Dylan	263	0.44

Samples of the new low-pressure polyethylenes were tested under the same ZST test conditions with the results shown in Table III, above.

Conclusions

In comparing the data from the various samples, it might be well to remember that there is probably a variable degree of branching represented and it is not known at this time in what manner branching influences the measurements.

On the basis of the data herein presented, it appears that the ZST test may be a useful grading device for polyethylene polymers. Its simplicity and semi-automatic features, coupled with the short time required for a test, should make it applicable to product quality control.—End

The Plastiscope

News and interpretations of the news

By R. L. Van Boskirk

(*Continued from pp. 35-40*)

Price changes for resins

Declines in the price of various plastics resins have been developing over the past few months almost as fast as they can be recorded. There is certainly no guarantee that this trend can continue, but the fact that plastics materials prices are being reduced while costs of nearly everything else have been increasing is a feature that the plastics industry should be able to pounce upon in the competitive struggle with other materials. Also not to be overlooked is the zest that it adds to competition between plastics materials themselves.

The universal claim made by company executives is that these price reductions have been made because of increased production, broadened markets, more efficient operation, and so on ad infinitum. But the average American is more easily convinced that the compelling reason is that good old American habit called "competition."

Here is the catalog on recent price announcements:

Methyl methacrylate molding material is now 59¢—third reduction in 18 months. A special extrusion material is only 55 cents. Vinyl chloride basic resins are now 27¢—the starting price for vinyl 25 years ago was $1.00 a pound. Polystyrene molding material was 88½¢ in 1937—today it is 29 cents. Styrene monomer of polymer grade was 34¢ in 1939—it is only 20½¢ today and rubber grade monomer is 16½ cents. Saran when commercially introduced in 1941 was 54¢ a lb.—today it is 39 cents.

Nylon plastic in carload shipments is now $1.33—the second price cut in less than a year when it was up in the $1.60 range. Mylar in the most commonly used gages is now $2.25 a lb. in comparison to $3.00 when it was introduced. Even ½ mil gage is now only $2.75 compared with the $3.50 it previously sold for. The light gage, because of its great strength and clarity, is designed to compete with other thicker plastics films.

*Reg. U.S. Pat. Off.

Melamine is now 2¢ cheaper than a month ago—45¢ for dinnerware grade and 52¢ for general purpose. Silicone mold release emulsions are now $1.26 a lb. in comparison to $2.60 when they were introduced in 1946.

Most other plastics have a similar history. Polyethylene, for example, has declined from $1.00 a lb. in 1942 to 41¢ today. Price has invariably declined as volume goes up, but there almost always comes a point when competition speeds up the process. That point comes when the price gets low enough to make the plastic material economically competitive in new markets. Vinyl in floor covering is one example. When such an event occurs, competition comes not only from other materials, but between members of the industry themselves.

Undoubtedly, the recent decline in vinyl chloride to a 27¢ base price is at least partially due to the competitive situation at the supply line. Today there is capacity in the United States for at least 650 million lb.—probably more. Foreign capacity may be at least 250 million lb. some time in 1957. Sales of domestically produced resin in the United States, including the amount exported, were probably not over 510 or 520 million lb.—a tremendous growth over 400 million in 1954 but still not up to capacity.

Since foreign resin was being imported at a rate of almost 50 million lb. a year in October 1955 and since there is overcapacity in the United States, "sump'n had to give." The 27¢ price is just a fraction under that at which foreign resin was being sold here. If the foreign price goes down more, American resins will probably decline.

Another competitive factor could be the trend toward vertical integration of supplier and processor which has frightened several of the latter and driven them to build their own resin plants. Still another has been the tendency for vinyl resins to find different markets year after year with the result that new companies are tempted to enter the field, despite the certain conclusion that already established firms would eventually lower the boom on profit margins.

The conclusion reached in this corner is that the total 30% cut in vinyl chloride prices since last July will either broaden the market enough to tax total facilities for producing resin or else resin prices will go still lower. Present producers are rapidly approaching a state where they must operate at capacity in order to make a profit.

Furthermore, they will soon be broadening their range of materials.

Already there is a 30¢ plastisol; a 28¢ organosol; resin for unplasticized use at from 32 to 45¢; a blending resin at 55¢; and many others. This tendency will grow fast in the future. The name for the 1965 resin isn't even known today, but it will certainly be different and different equipment will be needed to produce it. Any producer who doesn't have the research facilities or know-how to keep up with the parade is likely to find his resin as obsolescent as a dinosaur if he isn't ready to make quick changeovers.

(To be continued in this column next month.)

Electrical grade polyethylene

A series of electrical grade polyethylene resins, designated as Petrothene 300, has been introduced by U. S. Industrial Chemicals Co., Div. of National Distillers Product Corp., 99 Park

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Ave., New York 16, N. Y. The new material meets a variety of electrical specifications for infantry field wire, line wire covering, television lead-in wire, high-frequency and high-voltage insulation, and, in general, all wire and cable insulating and jacketing applications.

Melt index values for the uncompounded grades are: Petrothene 300, 0.3; 301, 1.0; and 302, 2.8.

Consultant to industry

Research is as essential to the long life of a company in the plastics industry as is the necessity for maintaining a solvent operation. Many firms, however, are not equipped to maintain a satisfactory research organization or are too hard pressed to keep up with the parade. These companies, therefore, frequently employ consultants to handle the job for them.

Included among the list of consultants engaged in this type of activity is the firm of De Bell & Richardson, Inc., Hazardville, Conn., which recently published an attractive booklet concerning its activities.

So far as known, De Bell & Richardson is the only independent consulting firm devoted entirely to plastics research which operates a complete establishment, including chemical and engineering laboratories, machine shop, compounding laboratory, full-size equipment for the pilot manufacture of plastics products, and a pilot plant for the manufacture of synthetic resins. The buildings occupy 40,000 sq. ft. of space on a 40-acre tract of land. Every phase of the industry can be "researched" in some one of the company's various departments.

De Bell & Richardson points out that their chief endeavor is to give its client a chance to work out all new developments quickly and effectively enough to obtain a competitive advantage. Most clients already have research organizations but are either unable to schedule their project early enough to give it the right timing or find that it involves a branch of technology for which their or-

Our New Engineering Editor

Upon the resignation of Fred B. Stanley from the staff of Modern Plastics Magazine and the Modern Plastics Encyclopedia issue, the publishers are pleased to announce the appointment of James F. Carley, B.S., B.Ch.E., Ph.D., as Engineering Editor of both publications.

Dr. James F. Carley

Dr. Carley did both his undergraduate and graduate work at Cornell University. In between, he was an Ensign (Communications) in the U. S. Naval Reserve. His education has included chemical engineering, mechanical engineering, and industrial engineering. At Cornell he taught unit operations and industrial statistics.

From 1950 to the end of 1955 Dr. Carley was a research engineer in the Polychemicals Department of Du Pont, where his principal assignments were concerned with plastics extrusion, extraction-extrusion of wet polymers, criteria of stability for molding powders, problems of injection molding and the preparation of problems for electronic computers. On a part-time basis he has taught many of the undergraduate mathematics courses for the University of Delaware Extension.

Singly and with collaborators he has contributed a number of technical articles to the literature.

Dr. Carley comes to Modern Plastics at a time when the whole industry is concerned with rapid advances in resin technology and in design of processing equipment for mass production. Already well known to some segments of the industry, he is sure to be welcomed by all because of his knowledge, his enthusiasm, his articulateness, and his genial personality.

To Fred B. Stanley the staff of Modern Plastics offers its best wishes for a most successful career in his chosen field of consultation. With his training at Massachusetts Institute of Technology, his 12 years of work in the industry with such leading organizations as Mack Molding Co., his recognized assistance to the Armed Forces in military applications of plastics, and his 13 years of service to the industry as Engineering Editor of Modern Plastics, Mr. Stanley has a background which should enable him to broaden his scope of usefulness to the plastics industry and to industrial end users of plastics.

The Plastiscope

ganization is not adequately manned or equipped. The company has completed 1077 projects in the last 10 years, including not only manufacturing problems but economic analyses, litigation and patent studies, personnel training, and manufacturing plant design.

S.P.E. elects

Attendance at the 12th National Conference of the Society of Plastics Engineers, Inc., held in Cleveland, Ohio, January 18 through 20, 1956, was the highest in the history of the Society, with more than 2100 technical people attending.

At the conference, the following slate of national officers for 1956 was elected:

President: Jerome L. Formo, director of plastic research, Minneapolis-Honeywell Regulator Co.; vice president: Jules W. Lindau III, president of Southern Plastics Co.; secretary: Peter W. Simmons, sales engineer, The Dow Chemical Co.; and treasurer: Wayne I. Pribble, president, Pribble Plastics Products, Inc.

The program of the meeting and abstracts of the papers presented thereat were previewed in Modern Plastics 33, 131 (Jan. 1956).

Polystryrene abroad

The recent announcement by The Dow Chemical Co., Midland, Mich., of the formation of Polychem Ltd., jointly owned by Dow and Kilachand, Devchand Co., Ltd. of India, to produce polystyrene for Indian molders, brings the total number of polystyrene plants overseas, wholly or partly owned by United States companies, to 12. Dow, in addition to the Indian plant (slated to start operations in the near future), holds a substantial interest in Distrene Ltd., Barry, South Wales, England, which has been producing polystyrene since the fall of 1955. Asahi-Dow, Ltd., Suzuka City, Nobeoka, Japan, jointly owned by Dow Chemical International, Ltd. and The Asahi Chemical Industry Co., Ltd., which has produced saran for the last two years, will start producing styrene in a new plant shortly.

Union Carbide and Carbon Corp. and its affiliates also maintain an overseas styrene operation, viz., Bakelite de Mexico, Monterrey, Mexico.

Monsanto Chemical Co. has extensive overseas polystyrene operations, as follows: Monsanto Chemicals (Australia), Ltd., at Melbourne, Australia; Monsanto Canada, Ltd., at Vancouver, B.C.; Shawinigan Resins Corp., of Canada, in which Monsanto has held a 50% interest since 1938; Monsanto Chemicals, Ltd., of England; La Societe Monsanto-Boussois, S.A., of France; and Monsanto-Kasei Kogyo Kabushiki Kaisha, Tokyo, Japan, which has been making polyvinyl chloride film and resins and will soon go into polystyrene production.

Koppers Co., Inc., has two foreign styrene operations, both in Brazil. Companhia Brasileira de Plasticos produces polystyrene and Companhia Brasileira de Estireno produces styrene monomer. Koppers has a part interest in both these companies.

Expansion

The Dow Chemical Co., Midland, Mich., is building two new plants for the production of Styrofoam, a lightweight, rigid styrene foam. The facilities, which are scheduled for completion this fall, are located on the Ohio River near Ironton, Ohio—to be known as the Hanging Rock plant—and on the Mississippi River at Pevely, Mo., 25 miles south of St. Louis—to be known as the Riverside plant.

Merrill H. Weymouth, who has served as superintendent of the Cellulose Products section of Dow's Plastics Production Dept. for over a year, will manage the Hanging Rock plant. **Robert E. Reinker** will manage the Riverside plant. Mr. Weymouth joined the company in 1929 and has been continuously engaged in a supervisory capacity in the production of cellulose materials at the Midland Div. since 1935. Mr. Reinker joined Dow's Chemical Engineering Laboratory in 1943. From 1946 to 1952 he was employed in the Physical Research Laboratory, saran plastic production, and as superintendent of the saran polymer plant. In 1952, Mr. Reinker was appointed technical advisor to the president of Asahi-Dow, Ltd., Japan, a Dow associated company manufacturing saran. He returned to Midland in 1954 to become economics engineer for the Plastics Production Dept.

B. F. Goodrich Chemical Co., Cleveland, Ohio, announces that its $5.5 million expansion program is nearing completion. **John R. Hoover**, president, states that plans for even further expansion are being made for 1956.

Plant locations named in the expansion program are at Avon Lake and Akron, Ohio; Louisville, Ky.; Niagara Falls, N. Y.; and Kearny and Haledon, N. J. Products manufactured at these various locations are Geon polyvinyl materials, Hycar American rubber, Good-rite chemicals, and Harmon colors.

Mr. Hoover reports that Goodrich vinyls are finding increasing use in foam, rigid pipe, and sheeting. The use of Hycar latex is increasing as a finish for upgrading textile products, such as wash-and-wear fabrics and denims. The new Good-rite chemicals introduced in 1955 were a synthetic resin flocculating agent and a liquid sand core binder for foundry operations.

An important step in the company's integration of raw materials was completed during the year when a new $9.5 million acrylonitrile plant began operating at Calvert City, Ky.

Associated chemical companies outside the United States continued their healthy growth. British Geon Ltd. increased production of vinyl materials during

The Plastiscope

1955, and Japanese Geon started construction of a new plant to double its capacity by the end of 1956. During the year, Geon de Brasil and Geon de Mexico began full commercial production of vinyl resins. B. F. Goodrich Chemical also engaged in engineering a new $3.5 million plastics plant for B. F. Goodrich Canada, Ltd.

Hercules Powder Co., Inc., Wilmington 99, Del., has started construction on a new $6 million pentaerythritol (PE) plant in Louisiana, Mo. The new facility is expected to be completed by the end of 1956 and operations are scheduled for early 1957. It will have an annual production of 24 million lb. of PE and 100 million lb. of formaldehyde, a basic raw material for PE.

Pentaerythritol is used in paints, varnishes, lacquers, and in core oils required for many castings, resins, adhesives, and in other chemicals. It has recently become of great interest to the plastics industry because of its use in the development of a new family of plasticizers and of Penton, a new resin that competes in the fluorocarbon market.

Hercules' first PE plant, in operation at Mansfield, Mass., since 1943, is now producing approximately 24 million lb. of PE a year.

The Plas-Tex Corp., 2525 Military Ave., Los Angeles 64, Calif., producer of polyethylene housewares, will double the working area of its present production and warehouse facilities. The expansion is expected to be completed by June. The company also announces that three new large injection molding machines will be added to its production facilities and that the capacity of its tool and die shop will be increased 50 percent.

Among the various housewares items which Plas-Tex features is an ice bucket and a wine chiller. The firm has also recently introduced a new pouring pail with lid, a 5-compartment cutlery tray, and a 10½-qt. rectangular dishpan.

Polyplastex United, Inc., 441 Madison Ave., New York 22, N. Y., will construct a new plant in Union, N. J. **H. W. E. Riley**, president of the company, anticipates that the new facility will nearly triple Polyplastex production capacity for decorative plastic sheeting and related products.

The new factory is more than double the size of the present plant in New York. In addition to the plant area, the building will house the firm's general offices, and design and research divisions.

In order to finance the expansion, Polyplastex common stock was recently offered to the public for the first time.

Until several new products are ready for production, the facilities of the new plant will be devoted primarily to the manufacture of decorative plastic sheeting combining fibrous glass and vinyl. This type of laminate is used chiefly by the lighting industry.

The company will continue to operate its St. Petersburg, Fla., factory where it manufactures rigid and flexible decorative vinyl laminates which incorporate natural materials, such as fabrics, fibers, grasses, leaves, and even butterflies, as the decorative and reinforcing medium within the sheet. The markets for these materials include room dividers, wall coverings, lighting, furniture, surfaces, and other architectural and industrial applications. Polyplastex will continue to maintain its showrooms and offices in New York and Chicago.

Reichhold Chemicals, Inc., White Plains, N. Y., announces that negotiations are in progress for the purchase of a 30-acre site for a second Pacific Northwest plant in the Tacoma, Wash., tide-flat area. Construction of the plant will be supervised by **H. O. Warner**, plant manager in Seattle. This will be RCI's thirteenth plant in the United States and its thirty-fifth throughout the world. The company opened its twelfth plant in Kansas City, Kans., a few months ago.

RCI's Pacific Northwest Div., of which **E. M. Skytta** is general manager, produces all types of adhesives used by Douglas Fir Plywood and associated industries, as well as pentachlorophenol which is used in wood preservation. Manufacture of resin and formaldehyde will be continued in Seattle, Wash.

The company also announces that Reichhold Chemicals (Canada) Ltd. has purchased a 112-acre site for a possible new plant in Canada. The tract of land is situated at Millhaven, Ont., near Kingston, on the St. Lawrence waterway. RCI already operates plants at Port Moody, B. C.; Ste. Therese de Blainville, Que.; and Toronto, Ont.

The Dow Chemical Co., Midland, Mich., will build a plant in Pittsburgh, Calif., for the production of synthetic latex.

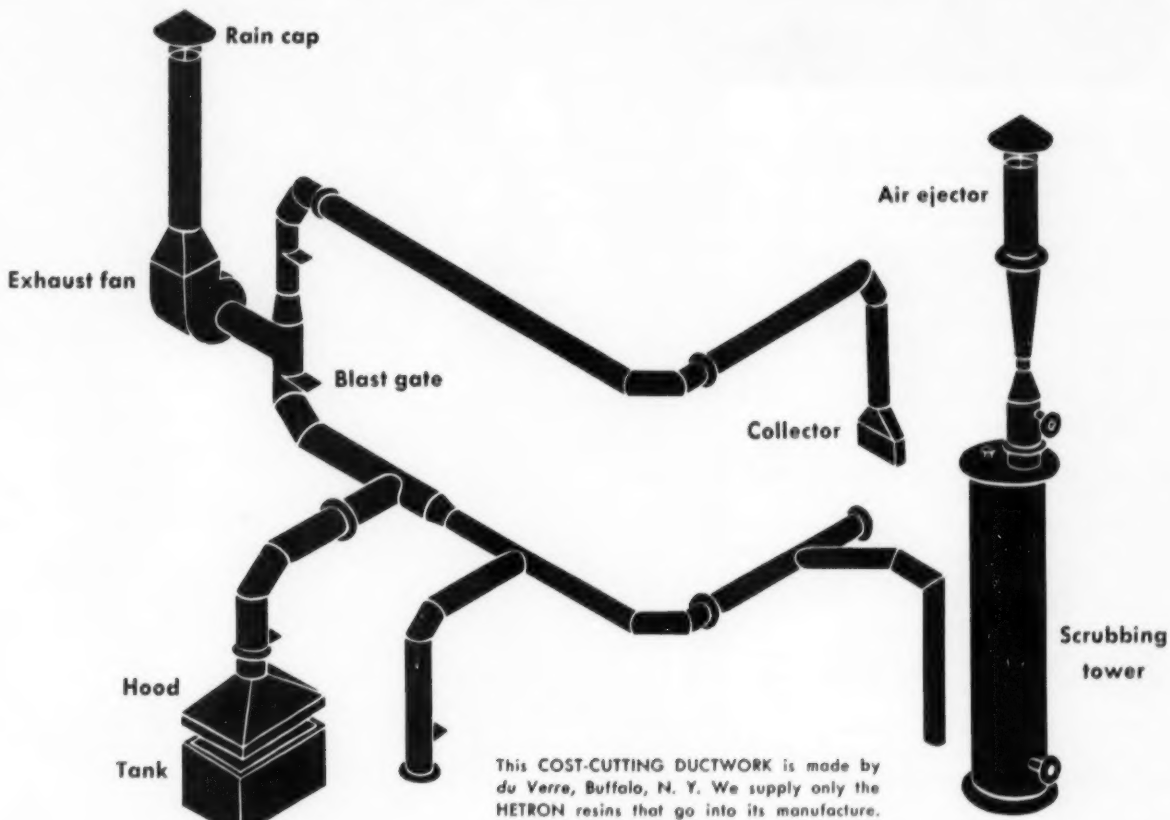
The new facility, which is expected to be in production this fall, will cost in excess of $1 million and will be capable of producing a broad range of styrene-butadiene latices which are used in the manufacture of paints, coated papers, and other products.

Similar latices are now being manufactured by Dow at Midland, Mich.; Velasco, Texas; and Sarnia, Ont., Canada.

Clopay Corp., Cincinnati, Ohio, has acquired the plant in Augusta, Ky., which was formerly operated as **L. V. Marks Shoe Co.** Clopay will use the new facilities to further expand the Plastic Film Div. currently located at its Elmwood Place, Ohio, plant.

The company will manufacture polyethylene transparent packaging film and its own Clopane clear vinyl film at Augusta. Principal users of Clopane vinyl film are manufacturers of garment bags, auto seat covers, furniture covers, oxygen tents, and rainwear. The film is also used in the textile and hardware fields as a wrap for premium products. Uses of Clo-

What idea-men are doing with HETRON®:



This COST-CUTTING DUCTWORK is made by *du Verre, Buffalo, N. Y.* We supply only the HETRON resins that go into its manufacture.

Fire-safe polyester ductwork

takes big bite out of corrosion costs

Ductwork like this, made from HETRON polyester, safely handles acid fumes that can eat through metal ducts in a few weeks.

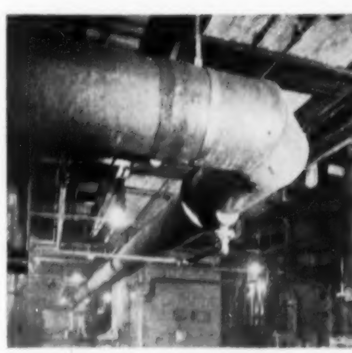
This ductwork has great structural strength and impact strength. It's so light that one man can pick up an 18-foot-long, one-foot-diameter section and walk away with it. Yet it costs less than anything else available for venting corrosive fumes and smoke!

And this ductwork is *fire resistant*—so can be installed in many plants where polyester could not have been used before.

Whole ventilating systems—complete with fume hoods, blowers, scrubbing towers, air ejectors, fittings—are being made out of this versatile, fire-safe polyester.

Where can you use HETRON?

Designers have also chosen HETRON for auto and truck body panels and structural members; aircraft parts; large boat hulls; machine housings; radomes; electrical insulating board and parts; "sandwich" structural and refrigeration panels; skylights, louvers, and industrial windows.



HETRON resins combine fire resistance with outstanding flexural strength, tensile strength, heat resistance, and very low water absorption. Using this light-stabilized HETRON, you can attain a high degree of resistance to weathering.

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Is there a place in your designs for this unique combination of strength-plus-safety? To find out, write today for complete data file on HETRON resins. Ask also for names of fabricators who can supply you with HETRON parts.

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pane in the do-it-yourself field are greatest for storm windows and glass replacement in greenhouses and cold frames.

A three-shift operation in the new plant is scheduled for June 1. Operations will be directed by **Daniel P. Geeding,** manager of the Plastic Film Div., with **Alfred L. Alk** as plant manager. **Henry Trounstine** is sales manager of the Plastic Film Div.

St. Regis Paper Co., 230 Park Ave., New York 17, N. Y., has acquired all the capital stock of **Chester Packaging Products Corp.,** Yonkers, N. Y. Chester produces polyethylene film; laminates and coats polyethylene to cellophane, foil, and kraft paper; and manufactures polyethylene pipe.

Chester will operate as a subsidiary of St. Regis, with its present organization and management.

Cadillac Plastic & Chemical Co. has been appointed distributors of Celanese Corp.'s Marco polyester resins and Bakelite's Krene flexible vinyl material.

The company will be the first reseller with national distribution for both Marco polyester and Krene. With headquarters in Detroit, Mich., and branch warehouses in Chicago, St. Louis, Los Angeles, and San Francisco, Cadillac services 20,000 accounts.

The addition of the Marco polyester line marks Cadillac's first entry into reinforced plastics distribution. It is now said to be the nation's largest warehouse distributor of thermoplastic sheets, rods, and tubes.

Cadillac also reports sales of $5,680,000 for the year ending September 30, 1955. The figure includes sales reported by subsidiary branch operations in Illinois, Missouri, and California. This represents a 60% increase over its 1954 sales of $3,600,000.

Principal factors in the sales gain were the opening, during or just prior to the fiscal year, of branch warehouses in Los Angeles and St. Louis. The two new operations combined sales of nearly $1 million. Another sizable gain was reported in the company's primary production of cast acrylic rods and tubes, which it markets under the tradename Cadco.

Mayon Plastics, formerly of Minneapolis, has moved into a new and larger building at Hopkins, Minn. The company was formed in 1946 to specialize in the production of vinyl tubing and hose. In more recent years, the firm has made a specialty of non-toxic food tubing.

In conjunction with the surgical department of the University of Minnesota, Mayon has helped develop a specialized non-leaching surgical tubing which is now being used in blood oxygenators and an intestinal tubing.

Urb Products Corp. has moved into larger quarters at Meadow and Bogart Sts., Brooklyn, N. Y., where the firm now occupies an area of 40,000 sq. feet. The new location represents a 50% increase in space over the former plant at 130 Prince St., New York, N. Y., according to **L. Kopelson,** sales manager.

The company is engaged in the fabrication of play pools (both rigid and inflatable vinyl in combination with canvas) and its line includes vinyl pools up to 10 ft. in diameter and 27 in. deep. Pools up to 20 ft. in diameter are being planned, using supported vinyl. A new feature is a testing ground where products will be subjected to rigid quality tests under simulated use conditions.

Foster-Grant Co., Inc., Leominster, Mass., announces that for the first time in its 37-year history, stock has been sold to interests outside the management of the company to help finance a $1,665,000 expansion program at its Baton Rouge, La., styrene monomer plant. This will make the second expansion at the Baton Rouge monomer plant since it was first built and put into operation in early 1954, with an asserted capacity of 25,000 tons, and will more than double production capacity.

U. S. Polymeric Chemicals, Inc., Stamford, Conn., has constructed new facilities in Santa Ana, Calif., for the impregnation of glass cloth, paper, and other materials. Production operations are expected to start shortly.

Belding Hemingway Co., Inc., 1407 Broadway, New York, N. Y., has negotiated a five-year loan of $2.5 million with two of its banks.

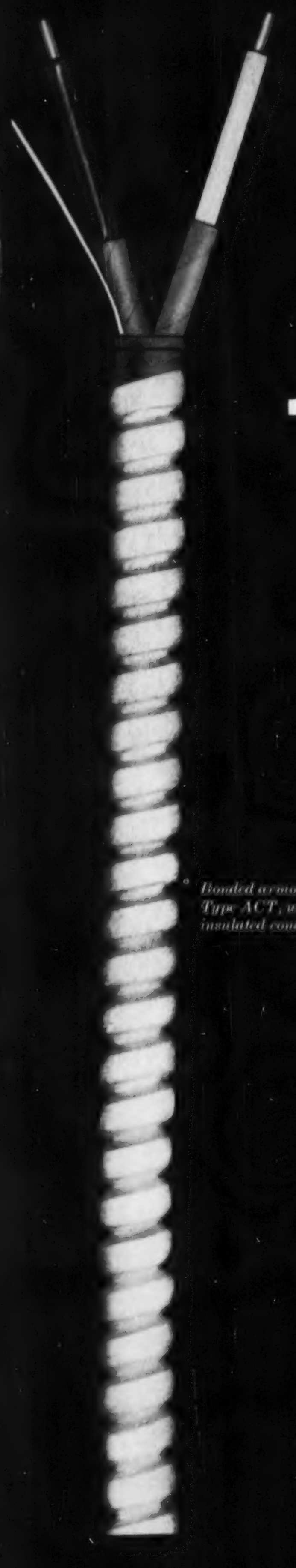
Increasing manufacturing facilities for the production of BCI nylon, the company's principal chemical product, is one of the reasons for Belding Hemingway's requirement for additional working capital.

Metal & Thermit Corp., 100 E. 42nd St., New York, N. Y., and **United Chromium of Canada, Ltd.,** Toronto, Ont., will combine its Canadian activities under the name of **Metal & Thermit-United Chromium of Canada, Ltd.** Plans are under way to build a new office, warehouse, and plant facilities in Toronto to house the joint operation.

Metal & Thermit is a large producer of tin chemicals as well as stabilizers for vinyl plastics.

Wyndmoor Mfg. Corp., established in 1951, announces that a two-third interest in the company has been purchased by **Industrial Raw Materials Corp.** Wyndmoor has recently completed its initial expansion program, including the construction and installation of new manufacturing facilities for the laminating, coating, impregnating, embossing, and vacuum forming of textiles, plastics, foils, and papers for the decorative and specialty fields.

The company will continue to manufacture its present line of Wynrap greaseproof and moisture-vaporproof barrier wraps, as well as provide laboratory and production facilities for the development and processing of cus-



Bonded armored cable, Type ACT, with Opalon-insulated conductors.

Another Monsanto First!

Armored cable with Opalon* vinyl insulation gets U-L recognition!

Opalon improves wiring efficiency—and helps simplify installation!

A new and more efficient armored cable construction has just been perfected. And for the first time cable utilizing vinyl insulation has won recognition from Underwriters' Laboratories.

Builders and electrical contractors will be impressed with the outstanding physical and electrical properties of this cable's conductors which are insulated with Monsanto's Opalon compound.

This thermoplastic coating is so tough it reduces the possibility of shorting when wires are pushed over sharp edges in the junction box. Stripping is neater and easier because there is no fraying of the insulation. Color identification is permanent.

This trail-blazing development in wiring was pioneered by three of America's most progressive manufacturers—Columbia Cable & Electric Corp.; Clifton Conduit, Inc.; and Ettco Wire & Cable Corp.—working closely with Monsanto. For data sheets and complete information on Opalon electrical compounds, write Monsanto Chemical Company, Plastics Division, Room 663, Springfield 2, Mass.

MONSANTO

*OPALON: REG. U. S. PAT. OFF.

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tom coating and laminating work for the general trade.

New equipment is now being proofrun for metallized Mylar decorative fabrics, as well as vinyl laminations to kraft paper for the specialty handbag and accessories trades.

Charles H. Sawyer, formerly affiliated with H. M. Sawyer & Son Co. and Kendall Co., has joined the company in an executive capacity. **Howard Feingold**, previously New York sales representative for Wyndmoor, has been retained and is working in an executive sales capacity with Mr. Sawyer.

The Wyndmoor plant is located at 1000 Roosevelt Ave., Carteret, N. J., and the administrative and sales offices have been moved to 575 Madison Ave., New York 22, N. Y.

Bassons Industries Corp., 1432 West Farms Rd., New York 60, N. Y., has purchased 100,000 sq. ft. of the former **Alexander Smith Carpet Co.** plant in Yonkers, N. Y.

The company expects the new facilities to more than double its present production output. Bassons will continue operations at its West Farms Rd. plant.

O'Sullivan Rubber Corp., Winchester, Va., is in its second year of extensive development work on the company's two major new products—Sullvyne-Clad, a lamination of vinyl sheeting on metal, and Sullvac, a thermoplastic rigid sheeting used for vacuum formed parts.

Development costs during that period were in excess of $300,000. Both products have been accepted for large-volume automobile application in 1956 and 1957 models.

Travis Fabrics, Inc., 350 Fifth Ave., New York, N. Y., has expanded its Industrial Fabrics Div. to include coating, laminating, and filtration of synthetic fabrics, such as nylon, Orlon, Dynel, and Dacron for the automotive, aircraft, electrical, and reinforced plastics industries. In addition, the line will include batting material in various weights of synthetic fibers for these same areas of activity.

The announcement is in line with the expansion program being put into effect in the Industrial Fabrics Div., a producer of fabrics based on nylon, Orlon, Dacron, cotton, and some of the newer fibers.

Jack W. Jerome has been named manager of the division.

Company notes

Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y., announces that **H. K. Intemann**, formerly vice president and general sales manager of Bakelite Co. since 1953, has been named executive vice president of **Electro Metallurgical Co.**, another di-

H. K. Intemann

J. D. Benedito

vision of Union Carbide. In 1930, Mr. Intemann joined Halowax Corp., which later became a part of Bakelite; in 1944, he became assistant general sales manager of Bakelite's Thermoplastics Dept. **John D. Benedito**, who joined Bakelite in 1935 and has been assistant to Mr. Intemann, succeeds the latter as general sales manager of Bakelite.

Hooker Electrochemical Co., Niagara Falls, N. Y., announces that **Clark R. Simmons** has been promoted to the position of advertising manager, **A. Vaughan Chinnock**, assistant advertising manager of chemicals, and **Wallace H. Kinz**, assistant advertising manager of plastics. Mr. Simmons joined **Durez Plastics & Chemicals, Inc.**, now a division of Hooker, in 1937 and became advertising manager of that division in 1955. Mr. Kinz joined Durez in 1953 as editor of publications.

The company also announces that **John F. Snyder, Sr.**, formerly vice president of Durez, has joined the administrative group at Hooker's headquarters. **Peter F. Casella** has been named manager of the patent section for Hooker. **George E. Patterson** has been appointed plant engineer of Durez' No. Tonawanda, N. Y., plant. Mr. Patterson joined Durez in 1946, worked on a pilot plant for the phenolic manufacturing facilities at Kenton, Ohio, and was project engineer there until his new appointment.

Monsanto Chemical Co.'s Plastics Div., Springfield, Mass., announces the following appointments: **Edmond S. Bauer**, formerly sales manager for industrial resins, has been named assistant director of sales for resin products. **Thomas W. Sears** succeeds Mr. Bauer as sales manager of industrial resins. Mr. Bauer joined the division in 1942 as a research chemist. He will now be responsible for the sale of industrial, textile, and paper resins. Industrial resins include foundry, laminating, abrasive, friction, and thermal insulation resins. The textile and paper industry resins are used for finishes, sizes, coatings, and catalysts.

Dr. R. W. Ayers, who has been with the division since 1940, has been appointed assistant director of engineering. **Salvadore P. Lio**, formerly manager of the company's Mexican plant since 1950, is now assistant sales manager for styrene molding materials. **Dr. Harry M. Walker** has been promoted to manager of research development at the division's research laboratories in Texas City, Texas.

Hercules Powder Co., Inc., Wilmington 99, Del., announces that **David R. Wiggam** has retired as manager of development of the Cellulose Products Dept. Mr.

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All the world over –'PERSPEX' sells the goods

'PERSPEX' is pre-eminent for advertising display signs—tough, good-looking, stands up to every kind of weather. It's available in clear and opal sheet, or in a wide range of transparent, translucent and opaque colours.

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J. B. Henriques, Inc., 521 Fifth Avenue, New York 17, N.Y.
Canadian Enquiries to:
Canadian Industries Ltd., Plastics Department, Box 10, Montreal P.Q., Canada.

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Wiggam has been instrumental in the introduction of several important Hercules' chemicals, including high-molecular-weight polyethylene, ethyl cellulose, and CMC. **Paul L. Johnstone** succeeds Mr. Wiggam as director of development of the department.

The company also announces that **Dr. Harvey J. Taufen** has been named director of development of the Synthetics Dept. to succeed Mr. Johnstone. **Donald H. Sheffield** has been appointed assistant general manager of the department.

Catalin Corp of America, 1 Park Ave., New York 16, N. Y., announces that **Jack Weiss** has been elected vice president of the company. Mr. Weiss joined the firm in 1931 shortly after the founding of the corporation and has served in the sales department in various capacities and most recently as special accounts executive.

J. Weiss

The company also announces three other appointments:

Robert A. Woodard has been named manager of advertising and sales promotion. He has served in various departments, including sales service and sales since joining the company in 1946. **Dr. Albert Goldstein,** formerly with General Foods Corp.'s Central Laboratories, has joined the firm. **James Mitchell** comes to Catalin from Riley Tar Laboratories.

Grace Chemical Research & Development Co., Div. of W. R. Grace & Co., 3 Hanover Sq., New York 4, N. Y., announces that **Gerard C. Heldrich, Sr.** has been appointed technical service director. Mr. Heldrich has had extensive experience in the production of polyethylene film and bottles. His 18 years in the plastics industry include service with Mills Plastic Div., Continental Can Co., Inc.; Gering Products, Inc.; Hercules Powder Co.; and Nixon Nitration Works. **Dr. Donald L. Fuller** has been named director of research. Dr. Fuller came to Grace from American Cyanamid Co. where since 1952 he had been technical director of the company's petro-chemical plant in New Orleans, La.

Package Machinery Co., East Longmeadow, Mass., and its wholly-owned subsidiary, **Reed-Prentice Corp.,** Worcester 4, Mass., have elected the following officers, according to a recent announcement by **Roger L. Putnam, Sr.,** chairman of the board of directors: **Donald H. Dalbeck** was elected president of Package Machinery and Reed-Prentice. He will also continue to serve as treasurer of both companies. **Roger L. Putnam, Jr.,** controller and secretary of Package Machinery, assumes the same positions for Reed-Prentice. **J. Joseph Kelly,** vice president in charge of sales, was elected to the Reed-Prentice board of directors. **Iver G. Freeman,** vice president of engineering and research, was named chairman of the Reed-Prentice Management Committee.

Loven Chemical of California, Newhall, Calif., has established a new sales division designated **Plastics Material Manufacturers of California.** The division will distribute products other than the phenolic molding compounds which the parent company produces. Plastics Material Manufacturers has already been named West Coast distributor for Seiberling Rubber Co.'s Plastics Div., Newcomerstown, Ohio, and for Isocyanate Products, Inc., Wilmington, Del.

Walter P. Bennett, formerly sales manager, has been named vice president in charge of sales; **Andrew Vacca,** previously plant manager, is now plant engineer; and **Ben Borgeson,** formerly plant superintendent, has been named plant manager.

Barrett Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y., has reorganized its sales and marketing structure for its new thermoplastics products, according to an announcement by **Carleton Ellis, Jr.,** director of plastics and resin sales. **H. A. Voskamp, Jr.,** formerly manager of thermoplastic sales, has been named to the newly created post of assistant manager of molding compound sales.

Mr. Ellis states that thermoplastic sales will henceforth be coordinated with the company's already established operations in thermosetting plastics under the direction of **Henry W. DeVore,** manager of molding compound sales.

Celanese Corp. of America, 180 Madison Ave., New York 16, N. Y., announces the appointments of **Edward H. Miller** as manager of sales development and **James W. Flynn** as assistant general sales manager of the Plastics Div. Mr. Miller has been associated with the plastics industry since 1926, when he joined the old Celluloid Corp., predecessor of the present Celanese Plastics Div. Mr. Flynn joined the company in 1943 and has served in various research, sales, and marketing capacities.

Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa., has moved its Pacific Coast office to the new Pacific Mutual Bldg., 600 California St., San Francisco, Calif., and its Atlanta, Ga., office to 1428 W. Peachtree St., N.W. The Pacific Coast manager is **K. L. Jopke.** At the Atlanta office, **A. K. Haynes** and **L. C. Harmon, Jr.** will service customers for textile chemicals and **R. W. Kruse** will serve customers for plastics.

Plas-Tex Corp., 2525 Military Ave., Los Angeles 64, Calif., manufacturer of plastic housewares, announces the following appointments: **Charles W. McGilvery,** of Dallas, Texas, has been named

sales manager. **Claude F. Fulton** and **Corrigan & Gane** have been appointed sales representatives. Mr. Fulton, with offices at 316 Merchandise Mart, Dallas 1, Texas, will handle the company's sales in Texas, Oklahoma, Arkansas, Lousiana, and Mississippi. Corrigan & Gane, located at 1420 Walnut St., Philadelphia, Pa., will cover eastern Pennsylvania, southern New Jersey, Delaware, Maryland, District of Columbia, and Virginia.

Ferro Corp's Fiber Glass Div., Cleveland 5, Ohio, has named **Ralph C. Riggs**, formerly sales manager of Johnson Plastic Corp., sales manager of its new West Coast facilities at Huntington Beach, Calif. **William G. Cole**, general manager, states that the plant which is expected to be in operation shortly, will make available a direct source of glass mat for the rapidly growing West Coast markets.

Ira A. Harmon, president of **Harkin Affiliates Inc.**, 331 Madison Ave., New York, N. Y., manufacturers of plastic molded boxes, announces the appointment of **Don Pober** as treasurer and partner of the company.

Mr. Harmon states that the firm has doubled its production for 1955 and plans to increase its stock box line during 1956 by investing $25,000 to $50,000 in molds. At present Harkin has 200 varied styled boxes in production in eight plants.

Acheson Dispersed Pigments Co., a unit of **Acheson Industries, Inc.**, has opened new executive offices in The Morris Bldg., Philadelphia 2, Pa. General offices and the purchasing department of the company will remain at 2250 E. Ontario St., Philadelphia. Orders should continue to be directed to the Ontario St. address.

Synco Resins, Inc. is the new name of the company formerly known as **Snyder Chemical Corp.**, Bethel, Conn. **William T. Hack**, president, states that the new name, based on the trademark for the company's products, expresses more clearly the corporate business, which will continue to be based on the synthesis of resins—particularly phenolics—to specific requirements.

A. E. Moyer is sales manager of the firm; **R. E. Derr**, technical director; **R. F. Gager**, research director; and **W. R. Johnston**, production manager.

Welding Engineers, Inc., P. O. Box 391, Norristown, Pa., announces that **John G. Hendrickson** has been appointed assistant to the president. **Richard H. Skidmore**, who has been with the firm for the past 10 years, has been promoted to director of research.

United States Rubber Co., 1230 Avenue of the Americas, New York 20, N. Y., announces that Earl Kochersperger has been named eastern regional sales manager of coated fabrics and **George Callum** sales manager of coated fabrics. Mr. Kochersperger will be responsible for sales of all Naugahyde vinyl upholstery in the eastern seaboard states.

Axel Plastics Research Laboratories has moved its laboratories and factory to larger quarters at 1061 Manhattan Ave., Brooklyn, N. Y. The firm's Industrial Sales Div. is located at 110 W. 34th St., New York, N. Y.

Ernest D. Carmagnola, design consultant, is now associated with **Samuel B. Eppy Co., Inc.**, 91-15 144th Place, Jamaica 2, N. Y. His former affiliations were with Brilhart Plastics Corp. as mold engineer and with Plastic Molded Arts Corp. as supervisor of the Engineering Dept. responsible for mold engineering and industrial design.

The company's new plant for injection molding, vacuum forming, and vacuum metallizing will be in production shortly.

Jaycee Chemical Corp. is now located on Route 22, Forest Ave., Northford, Conn.

Canadian Resins & Chemicals Ltd., 600 Dorchester St. W., Montreal 2, Que., reports the following appointments: **John R. Charlton** has been appointed to the newly created post of manager of new product development; **George M. Hale** has been named general sales manager; and **Walter E. Smith**, formerly manager of development, is now manager of the Industrial Products Div.

Fred A. Fogg has been named manager of the newly formed mechanical division of **G. T. Schjeldahl Co.**, Northfield, Minn. The division manufactures polyethylene film bag-making machines. The firm is also a processor of Mylar film, as well as a manufacturer of stratospheric balloons using Mylar and heat-sealing tapes for polyester films.

Metallizing Engineering Co., Inc. has moved its Eastern offices, factory, and warehouse to 1101 Prospect Ave., Westbury, N. Y.

Amos Molded Plastics, Edinburg, Ind., concurrently with the formation of the Amos Packaging Div., announces its entry into the film field.

The Carwin Co., Stiles Lane, North Haven, Conn., has made the following appointments: **Dr. Louis J. Owen**, who formerly headed the process development group, has been appointed to the Sales Dept. Dr. Owen will aid in the market development of Carwin's di-isocyanates and other new products. **Dr. Robert V. Smith**, previously in charge of the research group, has been named supervisor of organic chemical research and development. **Dr. Robert B. Holden**, formerly connected with Sylvania Electric Products' laboratory at Bayside, N. Y., has joined Carwin as supervisor of research in physical chemistry.

The Baker Castor Oil Co., 120 Broadway, New York 5, N. Y., announces that **John V. Reilly** and **Martin H. Smith** have been appointed sales representatives. Mr. Reilly will service the New York state area, except Staten Island and Long Island, and Mr. Smith will cover the Brooklyn-Queens-Long Island territory.

J. M. Huber Corp., 100 Park Ave., New York 17, N. Y., has formed a new sales division to serve the plastics, flooring, ceram-


Black Magic!
Witco-Continental Carbon Blacks
Black . . . always the ultimate in style and practicability. And to be sure you choose the right black for your product, specify one of Witco-Continental's carbon blacks for pigmenting. Witco-Continental channel and furnace blacks are produced in 5 modern plants under rigid quality control to give you consistently dependable performance. For nearly 30 years they have been noted for their uniformly high quality.
Witcoblak® No. 11—low color channel
Witcoblak No. 32—maximum jetness at low cost
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Witcoblak No. 100—jetter color. Nigrometer 74
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and . . . to meet your other plastics requirements . . .
WITCO offers a complete line of:
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ics, pesticide, adhesives, ink, paint, and food industries. Designated the General Industries Div., it will handle sales and marketing of Huber clays, carbon blacks, special pigments, and conditioners now being used by these process industries. **Ralph R. Browning, Jr.**, associated with the company since 1954 in market research and sales, has been named manager of the new division.

Automatic Molding Machine Co., Los Angeles, Calif., has named **West Coast Plastics Distributors, Inc.**, 8510 Warner Dr., Culver City, Calif., as its southern California distributor.

T. V. Jay Co., manufacturer of electro-formed molds for vacuum forming and plastisol molding, has moved to larger quarters at 2227 W. Belmont Ave., Chicago 18, Ill.

Worcester Moulded Plastics Co., Worcester, Mass., reports that **John I. Graham**, formerly superintendent of the Finishing Dept., has been appointed production manager of all manufacturing facilities and that **Bertram Graham**, works manager for the past three years, will now work directly under **Horace Gooch**, treasurer of the company.

Meridian Plastics, Inc., 250 Main St., Byesville, Ohio, has named **Travis Applegate Co.**, Grand Rapids 2, Mich., as its sales representative in that state.

Minerals & Chemicals Corp. of America has moved its entire Philadelphia, Pa., and Metuchen, N. J., operations to new general offices at Menlo Park, N. J.

Parkway Plastics, Inc. announces the opening of new offices and plant at Stelton Rd., New Market, N. J., and will engage in the manufacture of plastic packages and squat jars. **Edward W. Rowan** is president of the company; **E. Kirby Preston**, vice president; and **James A. Thomson**, secretary and treasurer.

Frank Plastics Corp., 2941 E. Warren St., Detroit 7, Mich., formerly a division of **Frank Paper Products Corp.**, is now an independent corporate unit. The plastics firm has purchased the tooling, plastics fabrication facilities, and proprietary lines of Frank Paper.

Officers of the new company are: **L. C. Frank**, chairman of the board; **Lew Frank, Jr.**, president; **Joseph Morrison**, vice president; **R. M. Young**, secretary; and **Morris Mandelbaum**, treasurer.

Millsplastic Div., Continental Can Co., announces that its sales offices, general administrative offices, and research department are now located at 2930 No. Ashland Ave., Chicago 3, Ill.

Young Brothers Co., Cleveland Ohio, manufacturer of industrial ovens, announces the election of **James D. Russell**, as vice president and general manager. He has been with the company since 1946.

A recent development in the firm's line is a continuous conveyor-type oven utilizing radio frequency energy. These new ovens are expected to have many applications in a wide variety of processes.

Sealomatic Electronics Corp., 429 Kent Ave., Brooklyn 11, N. Y., announces the appointment of three additional sales representatives to distribute its line of electronic heat sealing machines: **J. D. Robertson** of **The Robertson Co.**, Decatur, Ga., will represent Sealomatic in the southeastern states. **A. R. Williams Machinery Co., Ltd.**, Toronto, Ont., will handle sales and service for the Ontario region.

Durabilt Luggage has purchased **Pacific Plastics Co., Inc.**, manufacturer of reinforced plastics products. Pacific Plastics will continue its current operations under its present name at 2724 Sixth Pl., So., Seattle 4, Wash., with **Ben Rosen** as the new president.

The merger follows four years of research and development by Durabilt with reinforced plastics as a material for the manufacture of luggage. This new luggage is now in production and will be marketed throughout the United States and in several foreign countries.

Personal

George A. Fowles, sales manager of plastics materials of **B. F. Goodrich Chemical Co.**, Cleveland, Ohio, since 1954, is now director of the Chemical and Rubber Div., Business and Defense Services Administration, Washington, D. C. Mr. Fowles is the first plastics man assigned to this job which alternates among chemical executives every six months. He first worked with Anaconda Wire & Cable Co. in the development of rubber electrical insulations, and served the Government during World War II in expediting defense applications for polyvinyl chloride resins. Mr. Fowles joined The B. F. Goodrich Co. prior to World War II.

Robert F. Dettlebach will handle Mr. Fowles' former duties for such time as Mr. Fowles is on loan to the Department of Commerce.

Bernard R. Krashin has been appointed president of **Colton Chemical Co., Div. of Air Reduction Co., Inc.**, 60 E. 42nd St., New York 17, N. Y. Mr. Krashin was formerly vice president in charge of sales of the division. He was one of the organizers and has been in charge of sales of Colton Chemical Co., Cleveland, Ohio, since its inception in 1943. The business and properties of Colton Chemical were acquired by the parent company in June 1954.

Colton Chemical is a producer of polyvinyl acetate resins, polyvinyl alcohols, and other resin products used in adhesives and in other industries. One of the newest products of the division is

The Plastiscope

Colfoam Microballoons which are hollow resin spheres used to reduce evaporation losses in the storage of crude oil and gasoline. At the present time, production facilities of Colton are located in Cleveland, Ohio, and Elkton, Md.

Dr. Emil D. Ries, general manager of **Du Pont's Polychemicals Dept.**, has retired after 25 years' service with the company. Dr. Ries suffered a heart attack last summer and retired from active business on the advice of his physicians. He helped to guide the amalgamation of the Ammonia and Plastics Depts. into the Polychemicals Dept. in 1949 and became general manager of the new department. He was born in 1900.

Dr. Ries has been succeeded by **Dr. Robert L. Hershey,** formerly assistant general manager. Dr. Hershey became assistant general manager of the Ammonia Dept. in 1948, continuing in that capacity with the formation of the Polychemicals Dept. He was born in 1901.

R. L. Hock has been appointed manager of **American Cyanamid Co.'s** Fortier plant at New Orleans, La. Among the products now made there are acrylonitrile and other acetylene and ammonia by-products. Methyl styrene is scheduled to be produced at the plant some time in 1956.

M. H. P. Morand has been promoted to manager of coatings of **The Dow Chemical Co.,** Midland, Mich. He will be responsible for marketing Dow coatings in the plastics, paint, paper, textile, and other fields. Mr. Morand, formerly assistant to the manager of coatings sales, succeeded **Floyd J. Gunn** who became manager of the company's Los Angeles, Calif., office.

Dr. Carl Shipp Marvel, research professor at the Noyes Chemical Laboratory of the University of Illinois and an authority on synthetic polymers, has been awarded the American Chemical Society's Priestley Medal for 1956. Prof. Marvel directed a part of the World War II research on synthetic rubber. He has also contributed to the development of plastics of the vinyl polymer type, particularly those used in the production of transparent aircraft pieces, as rubber substitutes, and as thickening and blending agents in the chemical manufacturing industry.

James L. Foster, associated since 1944 with **B. F. Goodrich Chemical Co.,** Cleveland, Ohio, has been transferred to a new assignment at Goodrich-Gulf Chemicals, Inc. He will report to **J. E. Miller,** general sales manager.

Howard Luke has been named plant manager of **Tech-Art Plastics Co.,** Morristown, N. J. Mr. Luke has been associated with the company since 1948 in various engineering, sales, and management capacities.

J. K. A. Parkin has been appointed general manager of the polystyrene plant of **Kleestron, Ltd.,** London, S.W.1, England. The plant is located at Woodfield Road, Welwyn Garden City. Mr. Parkin was formerly group chief chemical engineer of Messrs. Laporte Industries, Ltd.

L. F. Davis, former assistant production superintendent, has been named plant manager of **Shawinigan Resins Corp.'s** Trenton, N. J., plant, which is now under construction and expected to go on stream by the end of the year. The company will manufacture polyvinyl butyral, the basic material for the interlayer in automotive safety glass.

John H. Drexler III, special representative for **Goodyear Tire & Rubber Co.'s Chemical Div.,** has been transferred from the Cleveland, Ohio, territory to the firm's New York office. Mr. Drexler has handled sales and service in the Cleveland territory, specializing in Plio-Tuf thermoplastic high-impact resins and Pliovic vinyl resins. In addition to these products, he will now handle Chemigum and Plioflex rubbers.

Richard A. Singer has joined **Nopco Chemical Co.'s Plastics Div.,** Harrison, N. J., as assistant manager in charge of Nopcofoams, a new line of flexible urethane and vinyl foams.

Walter J. Kaufman has been appointed manager of **Watson-Standard Co.'s Technical Div.,** Pittsburgh, Pa. He joined the firm in 1945.

Don W. Lyon, formerly manager of textile sales, has been promoted to general sales manager of **L.O.F. Glass Fibers Co.'s Textile Div.,** Toledo 1, Ohio. Mr. Lyon will supervise sales of the firm's glass textile yarns and roving to weavers and to the plastics, electrical, and allied industries.

Carl H. Bagen has been promoted to manager of technical sales of **Kaye-Tex Mfg. Corp.,** Yardville, N. J.

Henry Groppe has joined **Joseph R. Mares** in his practice as an industrial chemical consultant, with offices in the Commerce Bldg., Houston, Texas. Mr. Groppe was formerly assistant director of development of Monsanto Chemical Co.'s Plastics Div., at Texas City, Texas. He began his career in the chemical and petroleum industries as a research and development engineer with The Dow Chemical Co., Midland, Mich.

Joseph G. Cannon has been named field sales manager of the Tungsten and Chemical Div. of **Sylvania Electric Products, Inc.,** 1740 Broadway, New York 19, N. Y. Mr. Cannon will be located at division headquarters in Towanda, Pa.

Walter J. A. Connor, vice president and director of **American Plastics Corp.,** a subsidiary of

Heyden Chemical Co., has been appointed chairman of the technical conference on plastics to be held at the New Coliseum in New York City from June 11 to June 15. The conference will be held in conjunction with the Seventh National Plastics Exposition sponsored by the Society of the Plastics Industry, Inc.

William Dodenhoff, formerly director of sales, has been named vice president in charge of sales of **Kordite Co., Div. of Textron American Inc.**, Macedon, N. Y. The company manufactures plastic bags, bristle brooms, and freezer supplies.

Deceased

Dr. S. D. Douglas, senior scientist of **Carbide and Carbon Chemicals Co., a Div. of Union Carbide and Carbon Corp.**, died in Houston, Texas, after a long illness. Dr. Douglas was prominent in the development of vinyl chloride resins and received the John Wesley Hyatt gold medal in 1944.

Keith H. Williams, plastic molding materials salesman at **The Dow Chemical Co.'s** Chicago, Ill., office, died of injuries received in an automobile accident.

John G. Swanson, 68, died following a heart attack on January 27. Mr. Swanson was a "Plastics Pioneer" particularly remembered for his pioneering work in the development of multiple cavity, semi-automatic compression molding. In 1936 he organized the molding department of the Leviton plant in Brooklyn, N. Y., which is now one of the two or three largest consumers of phenolic molding powder in the United States.

Meetings

Plastics groups

March 8-9: The Society of the Plastics Industry Canada, Inc., Fourteenth Annual S.P.I. Canadian Conference, Sheraton-Brock Hotel, Niagara Falls, Ontario, Canada.

March 27: The Society of the Plastics Industry, Inc., Thir-

teenth Pacific Coast Annual Conference, St. Francis Hotel, San Francisco, Calif. Other meetings aboard ship, March 28 to April 2.

April 26-27: The Society of the Plastics Industry, Inc., Midwest Conference, French Lick Springs Hotel, French Lick Springs, Ind.

June 11-15: The Society of the Plastics Industry, Inc., Seventh National Plastics Exposition, New Coliseum, New York, N. Y.

Other meetings

March 19-23: American Society of Tool Engineers, Annual Industrial Exposition, International Amphitheatre, Chicago, Ill.

April 3-9: Commission on Macromolecules of the International Union of Pure and Applied Chemistry and The Weizmann Institute of Science, Rehovot, Israel. Subjects include: "General Behavior of Polymers in Solution," "General Behavior of Biocolloids and Polyelectrolytes in Aqueous Solution," and "Special Polymeric Systems in Solution."

April 9-12: American Management Association, Silver Anniversary National Packaging Exposition, Convention Hall, Atlantic City, N. J.

April 10-12: Point-of-Purchase Advertising Institute, Inc., Tenth Annual Symposium and Exhibit, Hotel Sheraton-Astor, New York, N. Y.

April 11-13: Research and Development Associates, Annual Meeting, Statler Hotel, Boston, Mass.

April 23-28: Manufacturing Chemists' Association, Inc., Third Annual Chemical Progress Week.

April 23-May 3: British Industries Fair, Olympia Hall, London, and Castle Bromwich, Birmingham, England.

May 6: American Institute of Chemical Engineers, Meeting, Roosevelt Hotel, New Orleans, La.

May 7-9: TAPPI Seventh Annual Coating Conference, Benjamin Franklin Hotel, Philadelphia, Pa.

Classified Advertisements

Modern Plastics reserves the right to accept, reject or censor classified copy.

Employment

Business opportunities

Equipment

Used or resale only

Machinery and equipment for sale

FOR SALE: 1—Royle #4 Extruder, motor driven; 1—6" x 12" Laboratory Mill, m.d.; 1—Ball & Jewell Rotary Cutter, size O :n.d.; 2—Baker-Perkins Size 15, 100 gal. Jacketed Mixers; 5—Horizontal Dry Powder ribbon Mixers, 4000#, 1500#, 500#; 1—New 3 Roll 6"x16" Laboratory Calender; 1—Farrell-Birmingham 60" Mill with reduction drive, 150 HP motor, floor level mounting; 1—Fitzpatrick "D" Comminutor, S.S. contact parts, jacketed; 1—Mikro Pulverizer #3th, with motor; 4—Reed-Prentice & W-S Injection Molding Machines, 2-16 oz.; Also other sizes: Hydraulic Presses, Tubers, Banbury Mixers, Mills, Vulcanizers, Calenders, Pellet Presses, Cutters. Send us your inquiries. What have you for sale? Consolidated Products Co., Inc., 50 Bloomfield Street, Hoboken, N.J. HOboken 3-4425, N.Y. Tel.: BArclay 7-0600.

FOR SALE: 3—Ball & Jewell #2, #1½ Rotary Cutters; 1—Cumberland #0 Rotary Cutter; 4—Two Roll Mills 20"x22"x60", 15"x40", 6"x14"; 3—Baker Perkins 100 gal. 50 gal., 2 gal., jacketed double arm Mixers; 1—Stokes Rotary Preform Press #DDS2; 3—Stokes Model "R" single punch Preform Presses; 1—Kux Model 15-25 Rotary Press; Also: Sifters, Banbury Mixers, Powder Mixers, etc., partial listing; write for details; we purchase your surplus equipment; Brill Equipment Co., 2407 Third Ave., New York 51, N. Y.

FOR SALE: (11) 75 ton record presses, complete @ $2,450, (11) new 100 ton, 10" ram, 10" stroke @ $1,100, (8) 200 ton, 9" stroke, 14" ram, 36x36 @ $1,850, (7) 200 ton, 9" stroke, 15" ram, 30x30 @ $1,650, (1) 50 ton complete, 18x18 @ $1,850, (1) 200 ton, 16" ram, 30x30 @ $2,450, (2) 200 ton, 16" ram, 42x42 @ $2,850, (1) 200 ton, 15" ram, 42x42 @ $2,450, (4) 250 ton, (2) 12" rams, 30x60 rebuilt @ $3,375. Hydraulic Sal-Press Co., Inc., 388 Warren Street, B'klyn, N. Y.

FOR SALE: Injection Molding Machines, 16 oz. H.P.M. Late type machines, 9 oz. H.P.M., 8 oz. W.&S., 4 oz. De Mattia. Mod. 252 Stokes closure press. Ball & Jewell plastic grinders. Aaron Machinery Co., Inc., 45 Crosby Street, New York 12, N. Y.

FOR SALE: Stainless Steel Rotary Dryer. Link Belt Co., 5'2"x16". No. 502-16, with all auxiliary equipment. Roto louvre also 6'x24' and 5'x26'. Hersey Stainless Steel Rotary Driers. Reply Box 6007, Modern Plastics.

SAVE With Guaranteed Rebuilt Equipment: Hydraulic Presses: Compression Molding Dunning & Boschert 2—12" ram 170 tons; 2—10" ram 118 tons; Wood 20"x20" 170 tons; Southwark 24"x24" 170 tons; Baldwin Southwark 4—26"x26" 8" ram 75 tons; 5—26"x26" 7" ram 57.7 tons; 5—15"x15" 8" ram 75 tons; 4—14"x14" 8" ram 75 tons; 2—19"x24" 10" ram 78 tons; 18"x18" 7" ram 57.7 tons; 3—12"x12" 7½" ram 66 tons; 8"x9" 4½" ram 24 tons, D&B 12"x12" 3" ram 10 tons; Transfer Molding 75 tons; Preform Presses 5½ T Colton and Stokes R, M.D.; Universal dual pumping units, 3—15 H.P; laboratory mills and calenders, also extruders, mixers, vulcanizers, injection molding units, etc. Universal Hydraulic Machinery Co., Inc., 285 Hudson Street, New York 13, N. Y.

FOR SALE: Stokes 150 ton semi-autom. hydr. Press. Kux 2½" dia. single punch Preform Machine. Leominster 8 oz. Injection Molding Machine. Farrell 15"x36" 2 roll Mill. Mills and Calenders up to 84". New Seco 6"x13" and 8"x16" Lab. Mixing Mills and Calenders. Plastic & Rubber Extruders. Brunswick 225 ton 21"x21" platens. French Oil 8 opening 315 ton 42"x42". Wat.-Stillman 75 ton automatic Molding Press 20"x20" platens. 200 ton Hobbing Press 18"x14" platens. New Loomis 340 ton, 24"x56" platens. D&B 150 ton, 24"x24" platens. Adamson 100 ton, 20"x 20" platens. Farrel 200 ton 20"x80" platens. Southwark 30 ton 14"x14" platens, semi-auto. Also Lab to 2000 tons from 12"x12" to 48"x48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump 250#. W.S. 4 Plgr. High and Low Pressure Hydr. Pump. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs. Hydr. Pumps, Accumulators. Stokes Automatic Molding Presses. Rotary & single Punch Preform Machines ½" to 4". Injection Molding Machines 1 oz. to 60 oz. Baker Perkins Jacketed Mixers. Plastic Grinders. Heavy duty mixers, gas boilers. Partial listing. We buy your surplus machinery. Stein Equipment Co., 107 8th Street, Brooklyn 15, N. Y. STerling 8-1944.

AVAILABLE AT BARGAIN PRICES. W.&P. 200 gal. Jacketed Mixer with sigma blades, tilting type bowl. Baker Perkins 200 gal. Double Arm Mixer with sigma jacketed blades, can be used with and without vacuum dome. J. H. Day from ¾ up to 100 gal., Imperial and Cincinnatus D. A. Jacketed, Sigma Blade Mixers. Day 15 to 10,000 lbs. Dry Powder Mixers. Gemco 2000 lbs. 56 cu. ft. Double Cone Blender. Mikro Bantam, 1SH, 1F, 2TH Pulverizers. Day, Rotex, Tyler Hum-mer, Robinson, Raymond, Gayco, Great Western Sifters. Colton 2RP and 3RP Rotary Tablet Machines. Carver Laboratory 20 ton hydraulic Press. Package Machy. FA, FA2, FA4, Miller, Hayssen, Wrap-King, Scandia, Hudson Sharp, Oliver Auto. Wrappers—all sizes. This is only a partial list. Over 5000 machines in stock available for immediate delivery. Tell us your machinery requirements.
Union Standard Equipment Co.
318-322 Lafayette St.
New York 12, N. Y.

FOR SALE: Heavy Duty Double Arm Sigma Blade Mixers. (4) Readco 50 gal. 30 HP; (2) W & P 100 gal; (1) Day 30 gal; (1) Banbury #3 with 75 HP motor. (2) Kux Rotary Pellet Presses. (4) Sprout-Waldron Horizontal Ribbon Mixers 336 cu. ft. (12,000#) capacity. (1) St. St. Pug Mill 7" dia. x 3'9" long overlapping chambers, jacketed 75#. (3) Mikro Pulverizers #2DH, #2TH, #3TH. (3) Fitzpatrick St. St. Comminuting Machines, Models D, K & F. We buy your surplus equipment. Perry Equipment Corp., 1429 N. 6th St., Phila. 22, Pa.

FOR SALE: One Lester 8 oz. Injection Molding Machine, Model L-2-8, new in 1952, complete with Wheelco controls, etc. Excellent condition. Can be seen in operation. Sterling Plastics Co., 1140 Commerce Ave., Union, N. J.

FOR SALE: (2) 300 Ton W S. Presses 20x 20 & 29x24 Platens. 140 Ton W.S. 22x16 Platen. 85 Ton Waterbury Farrel 20x24 Platen. 63 Ton Press 15x15 Platen with Pullback Cyls. 9, 8, 4, Oz. Injection Molding Machines. 15 Ton Lab. Presses 10x8 Platen. 10 Ton Lab. Presses 6x6 Platen Ball & Jewell Plastic Grinders. Standard Mystic Embossing Presses, Accumulators, Pumps, Valves. No. 252 Stokes Closure Press, 250 Ton W&S 28x24 Platens, 80 Ton Farrel 24x24 Platens. Many other Presses—Send for Bulletin. Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N.Y. Tel.: WAlker 5-8300.

FOR SALE: 1—60 oz. Reed-Prentice Inj. Molding machine, used very little, 2—32 oz. Reed-Prentice Inj. Molding machine. Top shape—like new. Reply Box 6000, Modern Plastics.

FOR SALE: 1—Birdsboro 880 ton self-contained compression molding press; 1—R D Wood 30 ton self-contained compression press; 1—French Oil Mill 100 ton transfer press; 1—National Erie 8½" strainer; 2—Cumberland grinders, 5 HP, 20 HP; also mixers, grinders, extruders, etc. Chemical & Process Machinery Corp., 52 Ninth St., Brooklyn 15, N. Y.

FOR SALE.
50-Ton Stokes Zelov #235 press. In excellent condition. Price $7,000.00.
Moldcraft Products, Inc.
1505 W. 41st Street
Baltimore 11, Maryland

FOR SALE: National 1½" Electrically Heated Extruder. New 1948. Capacity 30-35 lbs. per hr. Temperature up to 800° 3 HP.—complete with Boiler and a full set of Controls—used only 10 hours. Eveready Supply Co., 805 Housatonic Ave., Bridgeport, Conn., EDison 4-9471.

FOR SALE: Reed-Prentice 10D-8 ounce injection molding machine. 1947 model. Machine is in excellent condition and can be seen in operation in clean well maintained molding plant. Interested in selling to molders only. No machinery dealers, please. Reply Box 6031, Modern Plastics

FOR SALE: New in 1945—2—2,000 Ton and 2—750 ton National Erie compression molding presses. Good condition—principals only. Reply Box 6029, Modern Plastics.

(Continued on page 278)

(Continued from page 276)

FOR SALE: Six 15 ton Stokes automatic molding presses Model 200D2, $800 each, two 350 ton Transfer Presses complete like new, $12,500 each, two 75 ton Watson-Stillman presses complete, $2500 each, two Hartig Plastic Extruders—one 3½ $3100; one 4½ inch $3800, each complete with oil pre-heating tanks and motors. Reply Box 6033, Modern Plastics.

FOR SALE: Injection Presses: 4, 8, 12, 24 oz. Reeds. 2, 9 oz. HPM, 32 oz. vertical HPM. 8, 12, 20 oz. Lesters, 4 oz. Lewis, 12 oz. Watson, 1 & 2 oz. Van Dorns. Extruders: 4½" NRM electric heatd.—Cum-Step Dicing Mach.—Ovens.—Temp. Circulators—48" Stokes Vacuum Metallizer Setup 6"x12" Lab. Mill.—Markem Imprint Mchn. No. 25A.—Compression & Transfer Presses: 50 to 600 tons. 15 T. Stokes Automatics. Preform presses: Stokes No. 294, Colton 5½ T & #3 Rotary.—Auto-Vac 52"x30" Vac. Form. Mach.—200 T Hobbing Press. 24 & 16 Carrier Braid. Mach.—2—Laminat. Press. 18"x18" Pl.—4 open.—All Midwest Locations. List your Surplus Equipment with me.—Justin Zenner, 823 Waveland Ave., Chicago 13, Ill.

FOR SALE.
BP 200 gal. Jacketed Mixer, Motor Tilt, Sigma Blades with motor. BP 200 gal. Jacketed Mixer, Wheel Discharge Gate Sigma Blade with Motor. BP 50 gal. Jacketed Mixer, Motor Tilt, Fin Blades with Motors. W&P 100 gal. Jacketed Mixers, Motor Tilt, Sigma Blades with Motors. Complete Laboratory—Jacketed Mixers, Instruments, Glassware, etc. Tanks, Pumps, Compressors etc.
Reply Box 6053, Modern Plastics.

FOR SALE: Hydraulic Presses: R. D. Wood 2500 Ton, 8-Opening, 84"x54" Steam Platens. Elmes 1000 Ton Hobbing, M.D. Pump. Birdsboro 882 Ton, Down-Acting, 48"x48" Bed, Self-Contained. HPM 750 Ton, Down-Acting, 59"x44" Bed, Self-Contained. Farrell 625 Ton, 52"x52" Platens, Self-Contained. Watson-Stillman 600 Ton Hobbing, M.D Pump. Farrell 393 Ton, 2-Opening, 48"x48" Steam Platens. Elmes 350 Ton, Down-Acting, 30"x36" Bed, Self-Contained. Lake Erie 215 Ton, 36"x36" Platens, Self-Contained, Semi-Automatic. Farquhar, 100 Ton, Down-Acting, 30"x28" Bed, Self-Contained. Farquhar, 100 Ton Drawing, Down-Acting, 29"x34" Bed, High-Speed, Self-Contained. Watson-Stillman 100 Ton, Down-Acting, 22"x20" Bed, Self-Contained. Watson-Stillman 100 Ton, Burroughs 75 Ton, HPM 35 Ton Molding Presses. Watson-Stillman and Elmes 30 Ton and 20 Ton Lab Presses. Stokes Model 200D-2, 15 Ton Automatic and Stokes 300, 200, 150 and 100 Ton Semi-Automatic Molding Presses, All Self-Contained. Injection Machines: De Mattia, Model B, 24 oz. HPM, Model 350-H-16, 16 Oz. Reed-Prentice, 12 Oz., 1952 Machine. Reed-Prentice, 8 Oz. 1951 Machine, Watson-Stillman, 4 Oz. and 2 Oz. Van Dorn, Model H-200, 1 Oz. and 2 Oz. Tablet Machines: Stokes S-5, RD-4, RDS-3, R and T; Colton #5½, #5, #2-RP and #3-RP, Kux Model 64. Extruders: Royle Nos. 1, 3 and 4; Allen-Williams 8"—All Individual Motor Drive. Mills and Calenders: Farrell 18"x50" (4); Farrell 16"x40" (4); Farrell 15"x36" (2)—Available as Mill Lines or as Individual Units. Stewart Bolling 8"x16", 3-Roll Calender, 10 HP DC Variable Speed M.D. Rotary Cutters: Cumberland No. 0, 2 HP M.D. Ball & Jewell 1 HP M.D., Stainless and Plain. Miscellaneous: Vulcanizers, Grinders, Pumps, Valves, Platens, Etc. Johnson Machinery Company, 683—Frelinghuysen Avenue, Newark 5, New Jersey. Bigelow 8-2500. What Have You for Sale? What Are You Looking For?

FOR SALE: 60 oz. H.P.M. w/1200 ton clamp; 48 oz. Lester; 48 oz. DeMattia; 32 oz. Lester, 1950, $22,000; 32 oz. R-P, 1950, $26,000; 40 oz. H.P M., 1949, $27,000; 16 oz. R-P, 1948, $13,000; 16 oz. Impco, w/10 oz. cyl., $7,500; 16 oz. H.P.M. 1951, $15,000; 16 oz. H.P.M. 1946, $8,000; 12 oz. DeMattia w/16 oz. prepack, fully hyd., 1951/52, $10,000; 12 oz. DeMattia, $7,000, Terms; several 12 oz. Lesters; 8 oz. Reed-Prentice 1952, $9,500; 8 oz. R-P, single link, $3,750; 8 oz. Leominster, $3,750; 9 oz. H.P.M. 1946, $5,000; 9 oz. Monson, $5,500; 6 oz. R-P, $7,000; 8 oz. Reed-Prentice, rebuilt, $7,000; 4 oz. Lester, $3,000; 4 oz. Lester, fully aut., 1953, $8,500; 4 oz. Lester vert., $5,000; 4 oz. Watson-Stillman, $4,000; 4 oz. H.P.M., 1948, $4,500; 4 oz. Impco; 3 oz. Fellows, 1953, $8,000; 3 oz. Fellows 1951, $5,500; 2 oz. semi-aut. Van Dorn, lever type, $2,000; 2 oz. Moslos, 1954; Stokes presses, all types; DeMattias, horiz. & vert.; Italian extruders, granulators, Ovens; Let us list your surplus equipment. Acme Machinery & Mfg. Co., 102 Grove St., Worcester, Mass.

FOR SALE.
#3-oz. Fellows Injection Molding Press, 1953 Model. In splendid condition. Price is $8,000.00.
Moldcraft Products, Inc.
1505 W. 41st Street
Baltimore 11, Maryland

Machinery and equipment wanted

WANTED: Laminating or Polishing Presses, multiple opening, automatic self-contained preferred 12x14-60 ton to 22x27-175 ton. For sale: 2000 lbs. Nylon natural. Reply Box 6039, Modern Plastics.

WANTED DIRECT FROM OWNER. USED:
One Jacketed double arm Mixer 75 or 100 gallons. One Farrel or Thropp 15"x36" or 16"x48" Mixing Mill, 2 rolls. One Plastic Granulator or Pulverizer 500 lbs per hour. One Plastic Dicing machine. One Banbury Mixer No. 1. One Tabular Boiler Fuel-oil 15 or 20 H.P. One Knife Grinder 80". Submit complete details.
G. H. Grebe
24 State Street
New York, N. Y.

Materials for sale

FOR SALE.
6,000 lbs. Virgin White H. I. Polystyrene; 4,000 lbs. lt Green and Blue H. I. Polystyrene; 12,000 lbs. Reprocessed Red H. I. Polystyrene; 7,000 lbs. Virgin Pink Tinsel Acetate; 12,000 lbs. Natural and Colors C-11; 18,000 lbs. Red and Blue Polyethylene; 14,000 lbs. Silver Polyethylene. Samples and prices on request.
A. Bamberger Corporation
703 Bedford Ave., Brooklyn 6, N. Y.
Telephone MAin 5-7450

FOR SALE: 1700 gallons transparent sprayable-strippable Plastic Coating in 50 gallon drums. Also, 1090 quarts Polishing Compound for acrylic plastic. Samples available upon request. Best offer F.O.B. Los Angeles will take. Reply to Western Oil Reduction Co , 8472 Cypress Avenue, South Gate, California.

PLASTICIZERS: 20,000 lbs. DIOP prime quality in drums, very low price. Also 10,000 DOP, 5,000 DiButyl, 10,000 DiCapryl, 20,000 DiMethyl Phthalates & 10,000 TCP. Let us know your requirements. Small orders shipped from stock. Chemical Affiliates, Inc., 274 Madison Ave., New York 16, N. Y. Tel.: MU-3-4731

FOR SALE: 50,000 lbs. A-1 Top Grade Reprocessed Black Butyrate granules. Also 60,000 lbs. finest quality utility black high impact polystyrene granules. Both can be used in high quality production. Let us know your quantity requirements, and we will send samples and prices immediately. Marian Plastics, Inc., 21 Central Street, Leominster, Mass. LE 4-8265

Materials wanted

WANTED.
Plastics Scrap and Rejects of all kinds, Ground and unground. Also rejected molded pieces and surplus virgin molding powders. Top prices paid.
A. Bamberger Corporation
703 Bedford Ave., Brooklyn 6, N. Y.
MAin 5-7450

WANTED: Plastic Scrap. Polyethylene, Polystyrene, Acetate, Acrylic, Butyrate, Nylon, Vinyl. George Woloch, Inc., 601 West 26th Street, New York 1, N. Y.

PLASTIC SCRAP: Polystyrene, Hi Impact Polystyrene, Polyethylene and Acetate. Top Prices Paid. Plastic Moulding Powders, Inc., 2004 McDonald Ave., B'klyn 23, N. Y. ES 5-7943.

WANTED: Plexiglas and Lucite scrap, salvage and cut-offs, any quantity. Turn your surplus sheet stock into cash. Ask for our quotation. Duke Plastics Corp., 584 Broadway, Bklyn 6, N. Y. Evergreen 8-5520.

WANTED: Polystyrene: virgin, off color, clean reground, or reprocessed, all colors. End users. Sterling Plastics Co., 1140 Commerce Ave., Union, New Jersey.

SCRAP PLASTICS: All forms, waste and surplus plastic molding materials, rejects in any form. We will also buy your obsolete inventories of molding powders, stabilizers, plasticizers and other plastic and chemical materials. Industrial Surplus & By-Products Co., division of Aceto Chemical Co., Inc., 40-40A Lawrence St., Flushing 54, N. Y. INdependence 1-4100.

POLYSTYRENE SCRAP WANTED.
Top Prices paid for all forms of Polystyrene scrap. Reground, sheet, molded pieces, etc. Any quantity. For quick action phone or write:
Marian Plastics, Inc.
21 Central Street
Leominster, Massachusetts
LE 4-8265

WE ARE STEADY USERS of Rigid Vinyl Scrap. Will buy your regular generation of this scrap on a contract basis or in individual lots. Any Quantity. Reply Box 6044, Modern Plastics.

PLASTIC SCRAP WANTED: All types and grades, any quantity. Write or telephone, Success Plastics Recovery Works, Inc., Post Office Box 506, Indianapolis 6, Ind. Phone Liberty 6-2919.

MAT. WANTED: Lucite and Plexiglas Scrap and cut-offs. Also Styrene, Acetate, Butyrate scrap and surplus molding compounds from vacuum forming and injection molding operations. We buy any quantity at top market prices. Claude P. Bamberger, Inc., 152 Centre Street, Brooklyn 31, New York. Tel.: Main 5-5553. Not connected with any other firm of similar name.

Molds for sale

FOR SALE: New (never used) 24-cavity compression mold (12 covers-12 bases) for round box, 1⅞ inch inside dia., ¼ inch inside height. Don Juan, 67 Vestry, New York 13, N. Y.

FOR SALE: Injection Molds slightly used in first class condition: One 12-cavity 5" Pocket Comb Mold. One 8-cavity 7" Men's Comb Mold. One 6-cavity 8" Ladies' Dressing Comb Mold. One 6-cavity 7½" Ladies' Comb Mold with fancy back. All made of stainless steel. Reply Box 6025, Modern Plastics.

TOY TELEPHONE MOLDS FOR SALE: 2—Injection Molds and several Stamping Dies for complete assembly of Toy Telephone. Also, have some stock of finished phones and parts for sale. Write Milwaukee Plastics, Inc., 3070 West Capitol Drive, Milwaukee 16, Wisconsin.

FOR SALE: Complete set of molds to make fast-selling small Hobby kits. Wonderful opportunity for foreign manufacturer to buy at reasonable price. For complete information Reply Box 6043, Modern Plastics.

FOR SALE: One mold for 8" doll. One mold for 6" doll. One mold for 4" baby doll. One mold for 12" girl doll. One mold for 15" walking doll. All molds in good running condition. Reply Box 6026, Modern Plastics.

Molds Wanted

WANTED: Metal drape and vacuum forming molds for Xmas items for illuminated displays to be purchased outright or leasing arrangement. Reply Box 6002, Modern Plastics.

Plants for sale

AN IMPORTANT NOTICE: To the plastics chief engineer, mechanical engineer, product designer, sales manager or executive who can form an operating group . . . or . . . the company that is a large user of plastics, and wants to own its own facilities: This is a Unique Opportunity to Buy a Profitable Plastics Plant without Paying the Owner a Penny Down! The Chance Of A Lifetime—a sweet deal like this may never present itself! Here is a modern, 71,000 sq. ft. fully equipped plant—and your ONLY cash investment is in operating capital In Your Own Business! Actually, only a moderate outlay is required—$100,000—to be added to present working capital of $200,000, for expansion and new product development. Balance of the purchase price is to be paid over the years from earnings out of future sales and profits of the business, until purchase price is fully paid up. In Other Words—This Means You Are Paying for the Business Out of the Profits You Will Make. A Modern Setup—Complete And In Good Working Shape. Plant includes 23 modern injection molding machines, up to 200 ounce capacity, also extrusion—all in top condition, half of them only 3 years old. There's a complete tool room—painting and assembly. Plant is staffed with a top-notch crew that has everything under control. (Plant incidentally, is evaluated at only 50% of its actual worth). Optional Deals! Present vice president will purchase up to 25%. Note—this is a prosperous, mid-west business with a large volume operation, and even larger potential. Only reason for the sale is owners' desire to retire from active management. They will, however, continue as long as needed. Plant is for immediate sale, and **the right buy** (with long terms), for experienced plastics men who want a future, not a job; or company that wants to own its own facilities. (All inquiries are regarded as strictly confidential.) Get further details by writing Box 6008, Modern Plastics.

Help wanted

MOLD DESIGN-DRAFTSMAN: Experienced in compression and injection mold design. Excellent opportunity for advancement. Pacific Electricord Company, 3217 Exposition Place, Los Angeles 18, Calif.

SALES REPRESENTATIVE: Industrial Resins: Nationally known basic manufacturer has opening for sales and service representative in New Jersey, Delaware, Maryland, Eastern Pennsylvania and metropolitan New York City area. Age 21-35. Engineering degree or equivalent in training. Minimum of 4 years experience in sales or technical training in phenolics, ureas, polyesters. Replies held confidential. Reply Box 6047, Modern Plastics.

WANTED.
Chief Engineer for Medium Compression and Transfer Molder located in Western Pennsylvania. This is an excellent opportunity for the right man to join a young progressive company. Salary open.
Reply Box 6009, Modern Plastics

PLASTIC CHEMIST OR ENGINEER: Having some experience in the use of machinery for formulation and processing of thermoplastics. Salary commensurate with experience. Replies confidential Reply with resume to Box 6046, Modern Plastics.

COME TO TEXAS.
We have permanent opportunities galore for injection molding plant personnel—plant engineer, assistant plant superintendent, foremen, machine operators, maintenance men, set-up men. Inquire about foreman training program. Our employees know about this ad.
Loma Plastics, Inc.
P. O. Box 11277
Fort Worth, Texas

SALES REPRESENTATIVE: Man 30 to 40 to travel extensively in Europe as representative of AAA-1 American Company. Plastic Sales experience essential, Rubber Sales experience helpful. Furnish resume showing experience, education, languages, salary requirements, etc. Reply Box 6037, Modern Plastics.

GOOD FUTURE IN CANADA for plastics engineer: One of Canada's largest and fastest growing plastics manufacturers needs a fully qualified Plastics Plant Superintendent age 30-40. Applicants should have University Degree and experience in one or more of the following: compression moulding, injection moulding, extrusions, vacuum forming, low pressure laminating, fabricating and silastics. Good working conditions in new plant situated near Toronto, Ontario, extensive employee benefits and a salary commensurate with ability. Apply by letter outlining qualifications, age and experience, to: Personnel Manager, Smith & Stone Limited, 50 St. Clair Ave. W., Toronto, Ontario.

SALES TRAINEE: Young man to work as sales trainee out of Toronto Office for AAA-1 American Company. Plastic sales experience helpful. Furnish resume showing experience, education, salary requirements, etc. Reply Box 6038, Modern Plastics.

CHEMISTS AND CHEMICAL ENGRS.
For product development in plastics field. Outstanding opportunity to join recently formed Product Development Department of the Atlas Powder Company, located in Wilmington, Delaware. 5-10 years experience in polymers and their application uses required. All responses held confidential. Direct all replies, marked personal to,
R. L. Herrman
Atlas Powder Company
Wilmington, Delaware

SALES OPPORTUNITY: Division Sales Manager opening for man capable of heading National distribution of established line of plastic pipe, valves and fittings. A real future in a growing industry. Send resume of work experience and education to President. Reply Box 6042, Modern Plastics.

CHEMIST—COATED MATERIALS: Executive—Production—Control. We are seeking the services of a man technically trained with a varied, practical background. We are one of the highest quality custom coaters in our field, specializing in vinyl, organosol, plastisol, pyroxylin and adhesive coating and laminating, catering to the luggage, bedding, shoe goods, wearing apparel and industrial tape fields—Salary commensurate with experience. Reply Box 6032, Modern Plastics.

MANAGER NEEDED: Man with experience in the fabrication and sale of large fabricated units from polyethylene and polyvinyl chloride. Opportunity to develop this phase of business for established equipment producer. Send resume of work experience and education to President. Reply Box 6041, Modern Plastics.

INDUSTRIAL SALES.
We are seeking a chemist or chemical engineer to sell phenolic and urea resins to industrial accounts. Proven sales ability is essential. Knowledge of resins and plastics would be helpful, but not necessary. Excellent opportunity for a top quality man. Eastern territory, salary, bonus, all expenses. Our company is a large prime manufacturer of plastic materials with nation wide coverage.
Reply Box 6010, Modern Plastics

VICE PRESIDENT — PRODUCTION: Needed in polyethylene-extrusion lamination field. Young, rapidly growing company, growth area, mild climate. Salary open; stock option. Write giving all details of experience. Replies will be held in strictest confidence. Reply Box 6035, Modern Plastics.

DO YOU WANT TO LIVE in Sunny California where the climate is ideal all year 'round? We need experienced Tooling Engineers, Plastic Mold Designers, Tool & Die Makers, Injection Molders and Compression Molders. Write, wire or call Eldon Manufacturing Company, 1010 East 62nd Street, Los Angeles 1, California.

PLASTIC SALESMAN WANTED by Chicago area Custom Injection Molder. We are in the process of expanding and have a newly created position for the right man with proven background of accomplishment in Sales. Opportunity to become Sales Manager with executive capacity. Salary plus commission. Reply Box 6012, Modern Plastics.

PLASTICS INJECTION MOLDING: Shift Foreman. Must be thoroughly experienced in set-ups, trouble shooting and quality production. Excellent opportunity. Large Metropolitan N. Y. Plant. Reply Box 6021, Modern Plastics.

PLASTICS CHEMISTS.
Unusual opportunity for men experienced in processing of thermoplastic resins. Background is desired in one or more of the following fields: Injection molding; Extrusion (film, tube, and wire coating); Compression molding; and Laminating. Long-range prospects excellent for experienced men to work in a stable, progressive organization employing a staff of over 2100. Please write today to:
The Personnel Manager
Battelle Memorial Institute
505 King Avenue, Columbus 1, Ohio

GENERAL MANAGER—VICE PRES.: Executive graduate Engineer—to take full responsibility of small Plastic (60-90 Employees) Plant. Experience must cover extruded styrene operations. Vacuum, automatic and drape forming, molded phenolics—sheet or formed parts, "Gunk," etc. Must be detailed in production, engineering, and sales problems. Must have sales contacts and must be able to keep plant operating at required capacity with existing products and new products. Good salary and stock benefits. Reply Box 6030, Modern Plastics.

SHEET EXTRUSION VAC. FORMING: A new corporation in a new modern plant in the Chicago area has an excellent opportunity for a man with experience in polystyrene sheet extrusion and/or vacuum forming. This is a permanent position with a good salary and an excellent opportunity for further advancement. All replies held in strictest confidence. Reply Box 6019, Modern Plastics.

PLASTICS TECHNOLOGIST: Opportunity in San Francisco Bay Area for a chemist or chemical engineer with 3 to 6 years experience in the compounding and application of thermosetting resins and other polymers. Research involves the evaluation of new materials and the development of their uses. Please write giving personal and work history to: Shell Development Company, Emeryville 8, California.

PLASTICS PROCESS ENGINEER.
To plan and engineer production operations, methods, and equipment for one of the largest vacuum formers and reinforced premixed molder. A tremendous challenge and opportunity in new plant located in southwestern Ohio. Prefer graduate engineer with considerable experience in extrusion and vacuum forming, but will consider person with injection or compression molding background. All replies confidential. Reply Box 6017, Modern Plastics.

PLANT SUPERINTENDENT: Experienced in Manufacturing of Molded Phenolics—sheet or formed parts, extruded styrene—vacuum, automatic or draped forming. Seasoned in dies, molds, jigs and fixtures, methods, layouts, maintenance, and plastic machinery. Must be good at planning, scheduling production, handling labor, and producing a good, quality product. Plant located within 100 miles of Detroit—approximately 100 employees. Send complete resume and recent snapshot, also salary earnings in past five years. Reply Box 6028, Modern Plastics.

HELP WANTED: Maintenance engineer for plastic calenders, mills, banbury. Must be experienced. Reply Box 6050, Modern Plastics.

SALES ENGINEER wanted by well established plastic fabricator; main plant situated in southeastern Ohio. This is an excellent opportunity with a progressive company. Send resume with full details; strict confidence. Reply Box 6045, Modern Plastics.

MECHANICAL ENGINEER: Aggressive man, 30 to 45 years of age. Experience in production, industrial, and equipment engineering essential. To work in developing automatic processing of materials. Background in polyester, phenolic, and melamine molding compounding helpful. Reply Box 6052, Modern Plastics.

PLASTICS ENGINEER.
Plastics Engineer for Research and development work—at least 3 years production or development experience with polyester and epoxy-reinforced plastics is necessary. Mechanical ability is more important than knowledge of the chemistry of resins. Send resume of education and experience to—Personnel Manager, Johns-Manville Research Center, Manville, New Jersey.

THERMOPLASTIC PRODUCT ENGR.: Established custom molder in Newark area desires an engineer experienced in all phases of injection molding. Knowledge of materials and a thorough grasp of mold design are essential. Furnish complete resume including experience, education, salary desired. Replies treated confidentially. Reply Box 6018, Modern Plastics.

DEVELOPMENT AND RESEARCH Reinforced Plastics: An Engineer or Chemist is required to undertake laboratory and field investigations in the application of Polyester Resins. This is an unusual opportunity for a well trained technical man. Send full particulars to Hooker Electro-Chemical Company, Industrial Relations Department, Niagara Falls, New York.

Situations wanted

EXTRUSION ENGINEER: Process development engineer experienced in both pilot laboratory and production extrusion of polyethylene by flat film and blown tubing methods, also polyethylene sheeting and thermoplastics. Desire a challenging position with advancement opportunities. B.S.C.H.E., 31 years of age, married, family. Presently employed by well known company. Willing to relocate. Reply Box 6022, Modern Plastics.

POSITION WANTED: Vinyl Chemist, now employed, experienced in formulating and evaluating vinyl resins, plasticizers, stabilizers, etc. Reply Box 6051, Modern Plastics.

PRODUCTION MANAGER: Desires position with broader executive opportunities in production or Technical service. B.S. in chemistry, M.S. Ch. E. Over seven years diversified experience in all phases of compounding and extrusion conversion of all thermoplastics—reclaiming, reprocessing and virgin. Background of injection molding and materials, could also fill a technical service position. Prefer metropolitan area New York. Reply Box 6034, Modern Plastics.

EXPD. PRODUCT & PKG. DESIGNER: Man with broad experience and demonstrated accomplishment in product and packaging design seeks new connection with substantial future work load. This man a producer. An engineer (M.E.), well versed in appearance design, tooling and marketing, with strong plastics and paper background. Creative. Reply Box 6023, Modern Plastics.

EXECUTIVE interested in investing services and capital in growing plastics concern with genuine potentials for continued growth. Company should be able to use new ideas and investment capital to expand and consolidate its position. Investor member SPI and SPE with many valuable industry contacts. 8 years' experience with large eastern material manufacturer. College graduate, married. Location immaterial. Reply Box 6027, Modern Plastics.

SALES MANAGER: Reinforced plastics and compression molded products. Chemical Engineer with extensive development and industrial sales experience. Excellent contacts with industrial markets. Capable of handling complete custom engineering sales activities. Reply Box 6016, Modern Plastics.

PLASTICS DEVELOPMENT: BS, 8 years experience in compounding, coloring, extruding, molding, other development work on thermoplastics; supervisor of 30 man development group; strong administrative ability; publications; experienced in service work; excellent references; wants job in small town where he can breathe fresh air, forget commutors' special. Box 6049, Modern Plastics.

TECHNICAL SUPERINTENDENT with proven superior performance in Vinyl, Polyethylene, Polyamide wire extrusions, Vinyl Plastic Compounding, who conceived, planned, executed two successful Dry Blend installations with quality control—and development laboratory. Expert Colorist. Excellent organizer, fair but firm in personnel management, degree in chemistry, professional membership SPE. 50 years old, salary $10,000.—, will relocate, desires new connection with reliable organization. Reply Box 6003, Modern Plastics.

DEVELOPMENT-PRODUCTION: Friction Engineer. Responsible position wanted where demonstrated ability will lead to executive level. Several years experience in the brake lining field (woven and molded). Also familiar with the "dry process" and formulations of friction blocks or clutch facings with Phenolic resins. Have the ability to take complete charge and assume all responsibility in this field. Reply Box 6020, Modern Plastics.

SITUATION WANTED: Gentleman, 32 years of age, single. Past positions, works manager and production development engineer. Conversant with costing, production planning, method study, stores and stock control on batch and flow line production covering the following: p.v.c. sheeting, belting and spreading; resin glass low pressure fabricating and high pressure pre-mix moulding; general fabrication; impregnating; laminating. Seeks interesting and remunerative position with progressive company. Free March. Reply Box 6006, Modern Plastics.

Sales agents wanted

AGENT WANTED.
Important French Industrial Society in Paris founded in 1920, highest references, possessing an excellent commercial organization, will unite to its industrial activities an Exclusive Agent in France for the sale of highest quality products, rubber, plastics, industrial adhesives, articles for the use of footwear manufacturers.
Write Contesse et Cie.
8 Square de la Dordogne,
Paris 17, No. E.

MANUFACTURERS REPRESENTATIVE wanted by Chicago area Custom Injection Molder. Modern plant with tool room. Molding capacity up to 16 oz. with facilities for finishing molded parts. Commission basis. Most territories open. Reply Box 6011, Modern Plastics.

MANUFACTURER of rigid plastic sheets seeks manufacturer's representative for new line of optically clear, Cast Acrylic Sheets. Position requires calls on distributors, fabricators and end users. Enterprising salesman can attain high earnings with product much in demand. Commission basis. Reply Box 6014. Modern Plastics.

SALES REPRESENTATION.
Wanted in these areas—Ohio, Penna., Baltimore & Washington, Florida, Twin Cities. The introduction of miracle Mylar to the outstanding line of metallized plastic sheetings (which includes acetate, styrene, butyrate) has necessitated an expansion of the present sales staff for the foremost supplier in this field. Openings in the above areas are available to aggressive representatives. Terrific money-making opportunity.
Reply Box 6001, Modern Plastics.

DISTRIBUTORS or Sales Representatives wanted by East Coast Manufacturer of Electronic Heat Sealing machinery. Products advertised nationally. Excellent potential. Send full data with background and experience, territory covered, and present lines handled. Also seeking salesmen to work out of New York office in Metropolitan area. Reply Box 6013, Modern Plastics.

Miscellaneous

WE CAN SAVE YOU MONEY on your freight costs: on inbound materials and outbound products. This is how we do it: We procure freight rate reductions. We correct classification errors. We find money-saving routes for your shipments. We quote freight rates. We audit freight bills for overcharges. Write us today. A. J. Hemphill, Traffic Consultant, 318 Linden Ave., Montclair, N.J.

PLASTIC ITEMS WANTED: Suitable for advertising specialty distribution. Particularly interested in Banks, Automotive Specialties, Key Tags, etc., and any other plastic specialty that will take an imprint. Send details to Box 6005, Modern Plastics.

INVENTION AVAILABLE.
Razor blade dispensers. Container automatically reduces constant razor obsolescence and displacement by a competitor.
Reply Box 6015, Modern Plastics.

INJECTION MOLDING MFRS.: I have a patented article for use on women's and children's shoes. This could be easily manufactured, is flat and weighs approximately 1 oz. This must be molded of polyethylene. Seeking someone to take over idea on a royalty basis. Write: F. J. Mueller, c/o Plastiplate Co., Inc., 7-9 Holmes Ave., South River, N. J.

MANUFACTURERS: Do you need representation and distribution in New England? We are establishing a firm of Manufacturer's Representatives specializing in mill sizes of industrial plastics. We have 50,000 square feet of heated warehouse in Eastern Massachusetts. Boston, Worcester, and Providence are within 25 mile radius. We will warehouse and/or sell on straight commission or other mutually satisfactory arrangement. Reply Box 6024, Modern Plastics.

MANUFACTURERS' REPRESENTATIVE: Selling to automotive, refrigerator and appliance industries in Indiana, western Ohio and northern Kentucky for eighteen years—wants to represent an established plastic extrusion manufacturer located in this area. References gladly given. Reply Box 6004, Modern Plastics.

EXECUTIVES!! Don't read this advertisement if you can afford to miss a potential market of 15 million people. Aggressive technical sales representation can be yours by an experienced man located in Toronto, Canada. Best connections in the industry, with a thorough knowledge of raw materials and machinery for injection, extrusion and compression molding of Plastics. Reply Box 6036, Modern Plastics.

MODERN VACUUM METALLIZING plant in Canada with excess capacity desires to contact American manufacturer. Reply Box 6040, Modern Plastics.

LINES WANTED: Two top-ranking representatives desire connection with injection molder for exclusive representation in custom molding and sales promotion and premium field. Manufacturer must bear portion of expense for operation of New York office. Ready business waiting to be placed from large industrial and premium accounts. Will help install manufacturer in proprietary field—exclusive arrangement only. Reply Box 6048, Modern Plastics.

FOR SALE: One—Injection Molding Machine. Watson Stillman 8 oz. 6A-8 1941 $2,800 Complete. Good working condition. One—Glengary Weigh Feeder Model #GB4B. Like new. One—Ten cavity Corn Buttering Spoon Injection Mold. Molded samples mailed upon request. Ideal for premium or sales promotion. One—Two Cavity, Quart Size Beer Bottle Coaster Injection Mold. Garray Plastics, 331 Bergen Avenue, Kearny, N.J.

All classified advertisements payable in advance of publication

Closing date: 28th of the second preceding month, e.g., Feb. 28th for Apr. issue

Up to 60 words $10.00	Up to 120 words $20.00	Up to 180 words $30.00
Up to 60 words (boxed) $20.00	Up to 120 words (boxed) $40.00	Up to 180 words (boxed) $60.00

For further information address Classified Advertising Department, Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

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